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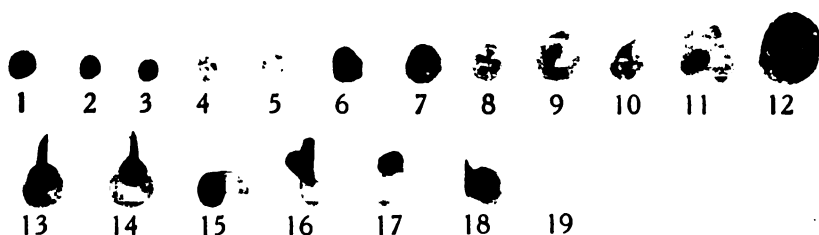


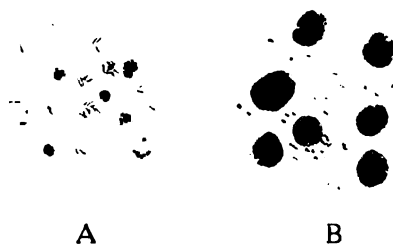
PLATE I.

Cells observed in cerebrospinal fluid stained with Unna's polychrome methylene blue



PLATE II.

1. Nonne
2. Ross-Jones
3. Noguchi (butyric)
4. Fehlings



A

B

PLATE III.

A. Tubercle Bacilli

B. Diplococcus intracellularis meningitidis

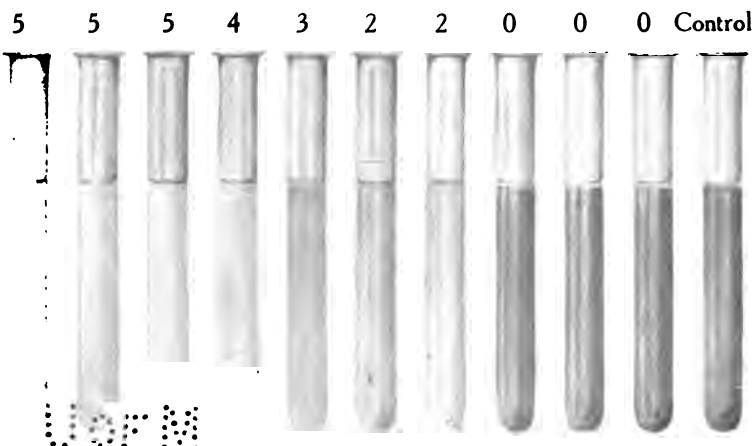


PLATE IV.

A typical Paresis curve. Colloidal gold chlorid reaction

(See page 5)

INTERNATIONAL CLINICS

A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PÆDIAT-
RICS, OBSTETRICS, GYNÆCOLOGY, ORTHOPÆDICS,
PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY,
OTOLOGY, RHINOLOGY, LARYNGOLOGY,
HYGIENE, AND OTHER TOPICS OF INTEREST
TO STUDENTS AND PRACTITIONERS

BY LEADING MEMBERS OF THE MEDICAL PROFESSION
THROUGHOUT THE WORLD

EDITED BY

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Diagnosis and Treatment

THE CEREBROSPINAL FLUID IN DIAGNOSIS

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Rochester, New York

THE trend of modern medicine is to utilize every available means for clearing up the obscure conditions which baffle the diagnostic skill of the physician. Our attention is now being directed to the examination of the cerebrospinal fluid. The value of this examination as a differential diagnostic agent in many obscure neurologic and psychologic disturbances is steadily growing in importance.

No direct analysis can be made in nervous and mental diseases, so our efforts must be expended in searching the secretions of the body for evidences of the products which attend pathologic alterations of the nervous tissue, particularly the brain. Our first efforts resulted in failure, because the search was made of the blood, urine, and feces, which represent the sum total of all of the metabolic products of the body. Nervous tissue comprises only about two per cent. of the total body, hence one can readily understand why such a small amount of products escapes detection. Examination of the cerebrospinal fluid has been more promising, and at the present time this examination is considered necessary as an aid in diagnosis in all obscure nervous conditions. The cerebrospinal fluid comes into more intimate relation with nervous tissue than the other secretions, so should contain the products of metabolism of nervous tissue in more concentrated and in least altered form.

The presence of the cerebrospinal fluid was first discovered in 1764 by Coligno, who thought it present only after death. Later it was found by Haller in the spinal cord, but he failed to note the relation between the fluid in the cord and the fluid in the ventricles. This relation was described in 1840 by Majendie in his description of the foramen which bears his name. It is now recognized that the

cerebrospinal fluid fills all the space of the cranial cavity not occupied by the vessels and nervous tissue. Many authors now agree that the principal source of the cerebrospinal fluid is to be found in the choroid plexus of the lateral ventricles, and that it is a true secretion. By equalizing pressure it is supposed to adjust the mechanism of the circulation of the nerve-cells. Its *pressure* is thought to equal or exceed intravenous pressure. Increase in pressure is frequently found in meningitis in all its forms, hydrocephalus, cerebrospinal syphilis, organic nerve conditions, brain tumor, and in traumatism of the brain. It may also be increased, at times, in tabes dorsalis, paresis, cerebral arteriosclerosis, chlorosis, and during epileptic attacks. Some knowledge, in a relative way, may be had of the pressure of the cerebrospinal fluid from the rapidity of the flow through the puncture needle, forty to fifty drops per minute being considered the average. A partially-blocked needle will give an erroneous estimate of the pressure, so where it is of much importance to know the pressure the needle should be connected to a vertical glass tube graduated in millimetres. The pressure of the cerebrospinal fluid in normal adults is quite variable, but should be about 120 mm. In the case of disease the fluid may give a pressure of from 200 to 800 mm. The knowledge of the pressure of the fluid is of value in determining the danger mark in its withdrawal. The minimal amount of fluid necessary for the examination should be taken—5 to 10 Cc. are usually sufficient for all the reactions if small tubes are used in making the tests. When large amounts are withdrawn rapidly unpleasant after-effects may follow, such as headache, nausea, vomiting, and pains in the back and neck.

Normally the *color* of the cerebrospinal fluid is that of clear water. In pathologic conditions it may become turbid or cloudy, due to cellular admixture. Turbidity of the fluid, when not due to the presence of blood, means an acute purulent meningitis. In tubercular meningitis the fluid is usually clear, rarely slightly opalescent. After standing a short time a delicate, fibrinous clot separates, in which the tubercle bacilli are especially abundant. In acute meningitis, due to the meningococcus, the fluid is not infrequently clear in the early stages. It is more often somewhat opalescent or blood-tinged, rarely thick and purulent. This last condition is more common in streptococcic or pneumococcic meningitis. In brain

tumor, hydrocephalus, cerebrospinal syphilis, tabes and paresis, and organic nerve lesions the fluid is clear. Recent hemorrhage or that caused by the puncture-needle may be recognized by the presence of red blood-corpuscles and a clear fluid after filtering the cerebrospinal fluid. The yellow-amber tint (Bard-Sicard) in the filtrate gives almost a certainty to the diagnosis of meningeal hemorrhage. It occurs in other conditions also where hæmoglobin or red corpuscles cannot be demonstrated (Klieneberger, Nonne). It has been observed in compression of the cord, intramedullary tumors, and intramedullary syphilis. An increase of globulin without lymphocytosis, and the yellow-amber tint, are of value in the differential diagnosis between compressing spinal tumor and primary disease of the spinal cord.

The *reaction* of the cerebrospinal fluid is decidedly alkaline.

Knowledge of the *specific gravity* of the cerebrospinal fluid seems to me to be without value as an aid in diagnosis. Increase in specific gravity in pathologic conditions, if present, is due to the increase of protein and the number of cells. In a doubtful nervous or mental disturbance the increase in specific gravity is so small that one cannot be absolutely certain that an increase actually exists.

CYTOLOGIC EXAMINATION

The cytology is probably the most important element in the study of the cerebrospinal fluid. When studied differentially it gives some insight into the severity of the meningeal reaction. The Wassermann and other reactions are of value in determining the etiology of the affection, but the intensity of the meningeal affection is more clearly shown by the cytology. There are three methods of examining the cerebrospinal fluid for its cellular elements: the French method, the Fuchs-Rosenthal method, and the Alzheimer method.

1. *The French method* was introduced by Widal and Rivaut in France and by Nissl in Germany. It consists in centrifuging 5 Cc. of the fluid for twenty or thirty minutes, and then removing one drop of the sediment, by means of a capillary tube, to a slide. The slide is then prepared and stained as any ordinary blood-smear. A negative slide will contain no cells or only an occasional cell, whereas the positive slide will show large numbers of cells. This method gives

only a rough estimate of the cellular elements and is by no means accurate.

2. *The Fuchs-Rosenthal method*, or counting-chamber method, is much superior to the centrifuge method of the French. The chamber of the Fuchs-Rosenthal instrument is 3 Cmm. in size instead of 1 Cmm., the size of the ordinary blood-counting instrument. The method of counting is similar to the method used in counting the leucocytes of the blood. The cells may be stained in the pipettes and a differential count made in the counting chamber by using a stain in the diluting fluid. Unna's polychrome methylene blue or the following may be used: 0.05 methyl-violet, 0.5 glacial acetic acid, 25 Cm. distilled water.

3. *The Alzheimer method* is a purely qualitative one, and when used for this purpose alone gives very satisfactory results. By this method the morphology can be studied with more precision and with greater accuracy. The following is Alzheimer's¹ technic: "In a centrifuge tube are put 10 or 15 Cc. of 96 per cent. alcohol, and then 5 Cc. of cerebrospinal fluid are added. The tube is closed with a rubber stopper, and is centrifuged for from one-half to three-quarters of an hour. Then there will be noticed at the bottom of the tube a distinct coagulum, which is marked in general paralysis, cerebrospinal syphilis, and meningitis, but which in normal subjects has the thickness of ordinary paper. The alcohol is poured off and the coagulum is fixed with alcohol, ether and alcohol, and ether. The coagulum becomes thick; it is taken out with a fine needle and embedded in celloidin, and sections are made." Sections may be stained with Unna's polychrome methylene blue, Unna's modification of Pappenheimer's stain, or methyl alcohol.

From 0 to 8 per Cmm. may be regarded as normal, 8 to 15 as borderland, while more than 15 cells per Cmm. constitute a pathologic increase. In acute meningitis the count may be from 200 to 2000 per Cmm. The cell count is useful for the establishment of the diagnosis of pathologic conditions of the meninges. Probably of as great importance is their aid in gauging the process of a given remedial agent. The borderland count is, with the questionable globulin or weakly positive Wassermann test, of no particular significance. Borderland counts should always be repeated within ten days.

The cells which one commonly finds in the cerebrospinal fluid

are the lymphocyte and the neutrophilic leucocyte. The eosinophilic leucocyte and the basophilic leucocyte are almost never found in the cerebrospinal fluid, except when included in blood contamination. Plate I shows the cells which one finds rather frequently in the cerebrospinal fluid. They are stained with Unna's polychrome methylene blue. Each of these cells will be discussed separately and their characteristics noted. The majority of cells found are the small lymphocytes. The cytoplasm of these is unstained and is visible as a small, clear ring about the nucleus, which is usually a fairly dark violet or blue. Occasionally the cytoplasm seems absent, and at times shows a slight accumulation at one pole. The nucleus is usually round, but may at times be slightly oval (Plate I, Nos. 1, 2, and 3). These small lymphocytes are smaller, as a rule, than the ordinary red corpuscles viewed with the same power lens. In pathologic fluids one frequently finds small lymphocytes that stain rather poorly (Plate I, No. 4). There is a very close resemblance between the poorly stainable small lymphocyte and the red cell which is old; the only point of difference is often that the entire body of the poorly stainable lymphocytes is covered with fine, small dots, which are not granules, but protoplasmic corrugations, whereas the old red cells (Plate I, No. 5) have a slight pinkish hue and no protoplasmic corrugations. The large lymphocytes are larger and show more cytoplasm than the small lymphocytes. The nucleus stains darker and the cytoplasm stains a pale blue (Plate I, No. 6). The differentiation between small and large lymphocytes has no special significance. A meningitis may show small lymphocytes at first and later small, large and the poorly stainable small cells. Increase in the cellular elements in the cerebrospinal fluid has a particular significance in diagnosis. Increase of lymphocytes may be observed whenever an irritation of the meninges is present, the amount depending upon the degree of insult. It is commonly observed in all cases of meningitis and in luetic processes, such as cerebrospinal syphilis, tabes dorsalis, and paresis. The more active the process the greater the variety of cells and the greater the number present. Lymphocytes may be found even in recent cases of syphilis which show no involvement of the nervous system.

The polymorphonuclear leucocytes are rather commonly found in the cerebrospinal fluid (Plate I, Nos. 7, 8, 9, and 10). They

are larger than the lymphocytes and are about twice the size of the ordinary red cells encountered in the cerebrospinal fluid. The cytoplasm stains a violet and contains granulations rather poorly made out. The nucleus stains much darker than the cytoplasm. These cells may be seen in all acute forms of meningitis, such as tuberculous, purulent, epidemic cerebrospinal, and in abscesses that invade the subarachnoid space. In acute forms of cerebrospinal meningitis luetica the presence of these elements is an expression of the acuity of the inflammatory process; they gradually diminish in number as the process tends to become chronic, and in many instances disappear entirely.

Epithelioid cells (Plate I, No. 11) are of infrequent occurrence and are apparently an accidental occurrence in the cerebrospinal fluid. They are somewhat larger than the polymorphonuclears, irregularly shaped, but may appear round. The cytoplasm stains evenly, the nucleus is small in relation to the cell and is clearly defined.

Plasma cells of Alzheimer (Plate I, No. 12) are quite frequently found in paresis, and are believed by Alzheimer to be suggestive of paresis, although many cases do not have them. It is not rare to find them in cerebrospinal lues. They are obtained by the Alzheimer method. The cells are large, usually elliptical, but may be round. The nucleus occupies an eccentric position and stains rather intensely with clearly-defined edges and showing marked chromatin staining. The cytoplasm is prominently and often irregularly stained, and contains frequently fine granules or inclusions staining darkly. They often show a tendency to lighter staining in the neighborhood of the nucleus. The cell is easily recognized by the eccentric nucleus and the prominent cytoplasm, which often appears to have a definite envelope. In some fluids it is the most striking element present. Many other morphologic forms of cells are to be found in the cerebrospinal fluid, large cells with eccentrically placed nuclei, large cells with tails, cells with overlapping nuclei, etc. (Plate I, Nos. 14, 15, 16, 17, and 18).

Degenerated cells or "clear elements" are of frequent occurrence. They stain with difficulty or not at all, except for small beads or wreaths of chromatin material variously placed. Their appearance often suggests that they are degenerated polymorphonuclear leu-

cocytes (Plate I, No. 19). There is no special benefit to be derived from the elaborate classification of Alzheimer¹ and Szesci.²

CHEMICAL EXAMINATIONS

In normal cerebrospinal fluid a small amount of a protein-complex group (0.03 to 0.6 per cent.) is present. This protein-complex group is usually spoken of as globulin. Increase in globulin is the most constant of the present known chemical changes to appear in the cerebrospinal fluid in pathologic alteration of the nervous tissue. The commonest finding indicative of meningeal reaction is the globulin, the positive Wassermann ranking next and the lymphocytosis last. A number of methods have been devised for determining an increase of globulin in the cerebrospinal fluid. Most of these are qualitative tests, but from them one can usually determine whether there is increase in the globulin content.

1. *Nonne Phase I Reaction.*³—This reaction consists of the addition of hot saturated solution of ammonium sulphate, which has been permitted to cool, to an equal quantity of cerebrospinal fluid; 0.5 Cc. to 1 Cc. of each is sufficient for the reaction. If the globulins are increased, there occurs a cloudiness or opalescence in the tube within three minutes. Normal fluids may give a faint opalescence or none. The amount of globulin is estimated from the rapidity of appearance of the opalescence and from its intensity. Comparison should be made with the reagent and with the cerebrospinal fluid alone in weakly positive or doubtful reactions (Plate II, Tube 1).

2. *Ross-Jones Reaction.*⁴—This test is a modification of the Nonne-Aspelt test. The same reagent is used, but, instead of mixing the reagent and cerebrospinal fluid, the cerebrospinal fluid is permitted to float on top. Within three minutes a white ring or zone appears at the line of contact. The presence of this ring or zone is considered to signify a globulin excess. Ross and Jones consider the importance of estimating the thickness of the ring, the time of its appearance, and the performance of the test with diluted fluids. The Ross-Jones test seems more satisfactory than the Nonne-Aspelt test; the end reaction is more constant, is less influenced by individual interpretation, and is sharper (Plate II, Tube 2).

3. *Butyric Acid Reaction (Noguchi).*⁵—The performance of the Noguchi reaction is as follows: To 0.1 Cc. of cerebrospinal fluid

add 0.5 Cc. 10 per cent. butyric acid in physiologic salt solution. This is boiled for a short time, and a quantity of a normal solution of sodium hydroxide, equivalent to the amount of cerebrospinal fluid used, is added. This mixture is again boiled for a few seconds. An increase of protein matter is characterized by the appearance of a granular or flocculent precipitate, which gradually settles to the bottom of the tube. The greater the excess of globulin the more pronounced is the precipitate. If the amount of protein is very small, the precipitate does not appear until after standing two hours. Such results are not considered as an excess. Although very well adapted to qualitative work, this method does not give a sufficiently accurate gauge regarding the quantitative relations of the excess (Plate II, Tube 3).

4. *Kaplin's Quantitative Estimation of the Protein.*—Kaplin has given us a method by which we can estimate the amount of protein in the cerebrospinal fluid and thus determine whether it is present in a normal or excess amount. The following is Kaplin's^e description of the test: "Into a test-tube 1 Cm. wide and 8 Cm. long is placed 0.5 Cc. of the spinal fluid to be examined. It is heated until it boils up twice; then three drops of a five per cent. solution of butyric acid in physiologic salt solution are added, followed immediately by 0.5 Cc. of a supersaturated ammonium sulphate solution, and the fluid set aside for twenty minutes. In adding the ammonium sulphate solution care must be taken to allow it to flow under the solution and not to mix the test-tube contents. After about twenty minutes an excess manifests itself in the form of a thick, granular, pot-cheese-like ring. When no granular, thick ring forms the fluid may be regarded as normal. Every fluid that shows the ring just described is further tested as to the intensity of the excess. For this purpose four other tubes receive each 0.1, 0.2, 0.3, and 0.4 Cc. of spinal fluid respectively, and each in turn is brought up to the 0.5 Cc. mark with distilled water. The same procedure is followed as for the first tube. The tubes are set aside for twenty minutes and readings taken then. The quantity of protein matter permitting a ring to appear in the tube containing only 0.1 Cc. of spinal fluid is designated as 0.1 excess, and marks the greatest degree of excess."

Tests for increased globulin in the cerebrospinal fluid are easier to perform than the cell count, and have practically the same diagnos-

tic importance. The tests which the writer most frequently makes use of are the Ross-Jones and the Noguchi butyric acid modifications of Nonne's Phase I reaction. After the performance of these two reactions for some time one can readily form a fairly accurate opinion as to whether the protein content is increased or not. Both tests are used in doubtful cases, so that one may serve as a check for the other. Both are increased under the same conditions; they are positive in all cases of acute meningitis and absent in meningeal irritation without actual inflammation; they are always present in tubercular meningitis, and their presence is an aid in the diagnosis. The absence of the globulin reactions in cases of suspected tubercular meningitis is of great value in excluding meningitis. The reactions are positive in general paralysis and in cerebrospinal syphilis (general paresis and tabes dorsalis in from 90 to 95 per cent. of cases); negative in brain tumor, cerebral arteriosclerosis, and psychoses. A positive reaction in a doubtful nervous case is presumptive evidence in favor of the diagnosis being a syphilitic or parasymphilitic disease of the nervous system. These tests give us a means, in doubtful cases, in differentiating between functional and organic affections of the central nervous system, but not between luetic and non-luetic conditions. The presence of globulin always means organic disease, while its absence, like most negative findings, is not of equal value in absolutely excluding organic conditions. It is almost always found in syphilitic nervous affections. In cerebrospinal syphilis, according to Nonne's statistics, it is present in about 100 per cent. of the cases, in tabes in from 90 to 95 per cent., and in paresis in from 95 to 100 per cent. of cases. It occurs with the greatest intensity in paresis.

The Capacity for Reducing Fehling's Solution.—In normal cerebrospinal fluid there is present a chemical substance which reduces Fehling's solution, and this is absent in some cases of meningitis and present in others. There appears in the literature on the subject considerable confusion as to the cases in which it is present or absent, and considerable uncertainty as to its value. According to Mott,⁶ the reaction is due to the presence of glucose. In pyogenic meningitis, pneumococcus, streptococcus, and mixed infection sugar is invariably absent. In cerebrospinal meningitis (meningococcic) sugar is absent in the acute stage, but may return in some degree as the infection recedes. In tubercular meningitis sugar is present,

except in very rare cases shortly before death, in which stage difficulty of diagnosis rarely exists. In poliomyelitis sugar is present. The method used is to boil together equal portions of cerebrospinal fluid and Fehling's solution in a narrow test-tube and allow it to rest in a sloping position. In the course of an hour there will be a marked yellow or red deposit forming a band on the lower side of the tube, and with a little practice one can readily form a fairly accurate opinion as to whether such a band is normal in amount or diminished. Where sugar is absent no deposit will occur (Plate II, Tube 4).

BACTERIOLOGIC EXAMINATION

The bacterial findings give us the only absolutely conclusive evidence from the examination of the cerebrospinal fluid. The most difficult of all the microbic invaders of the spinal canal to detect is the tubercle bacillus; the most commonly found microorganism is the tubercle bacillus and the *Diplococcus intracellularis meningitidis* of Weichselbaum; the pneumococcus is occasionally found, while the influenza bacillus, the ordinary pus-forming coccus, and the Klebs-Löffler bacillus are rarely seen. Other microorganisms have been reported as found in the cerebrospinal fluid, but are extremely rare. These are the gonococcus, the *Bacillus coli communis*, the *Bacillus pyocyaneus*, the *Bacillus mallei*, the *Bacillus anthracis*, the *Saccharomyces*, and the *Actinomyces*.

A pure lymphocytosis in a child should always suggest a tubercular meningitis, and a diligent search for the tubercle bacillus should be undertaken. If one is careful of his technic and is persistent he will be rewarded by finding the tubercle bacillus. Many methods have been suggested for finding the tubercle bacillus, but the easiest to perform and the most practical in the writer's hands is to place a small, round cover-slip in the bottom of a flat-bottomed vessel containing the cerebrospinal fluid. The sediment which will in this way be deposited upon the cover-slip will contain cells and tubercle bacilli. The cover-slip should then be removed, dried in the air, fixed by passing through a flame, and stained in the usual way for tubercle bacilli. Tubercle bacilli will in this way be present in large numbers. In non-tubercular cerebrospinal meningitis a smear made in this manner will show numerous polynuclear leucocytes and the meningococcus. Some of the meningococci are intracellular and un-

stained by Gram, a fact which will eliminate any question of the pneumococcus. (Plate III shows smears made by this method. They show the large number of bacteria which may be obtained by this method, whereas by other methods but few are found.)

SEROLOGY

The Wassermann reaction in the cerebrospinal fluid is highly characteristic of the syphilitic process, and, generally speaking, is of greater significance than the blood Wassermann when it is desired to establish the nature of a given nervous disorder. There is little or no relation between the blood Wassermann and the reactions of the cerebrospinal fluid. Owing to the independence between the blood and cerebrospinal fluid substances which produce the Wassermann reaction may be present in the cerebrospinal fluid and not present in the blood, or *vice versa*. In cerebrospinal syphilis the reaction occurs more often in the blood than in the fluid, while in tabes most observers agree that the Wassermann reaction is more frequently positive in the fluid than in the blood. Nonne, from his original experiences, sought to establish a differential point between the true syphilitic and the parasymphilitic affections. This opinion he has later modified because of a change in his experiences in regard to tabes. No hard or fast deductions can be made in regard to the presence or absence of the Wassermann reaction in the blood or cerebrospinal fluid, but, nevertheless, their value in differential diagnosis is of the greatest importance. A thorough knowledge of this reaction is absolutely essential to every neurologist who desires to be modern.

LANE COLLOIDAL GOLD CHLORIDE REACTION

One of the most recent of our laboratory tests applied to the cerebrospinal fluid is the colloidal gold chloride reaction. This test is based upon some of the observations made by Zsigmondy,⁷ in 1901, in his exhaustive work with solutions of colloidal gold. These observations are:

1. Colloidal solutions of gold or other metals are precipitated by proteins or electrolytes when present separately. The amount of reaction depends upon the degree of concentration and valency of the electrolyte.

2. Colloids are electrically charged and two oppositely charged colloids mutually precipitate one another, though only in definite quantitative amounts. If these amounts are exceeded in one way or the other, no precipitation occurs. The point at which protection ceases and precipitation begins is different for each proteid.

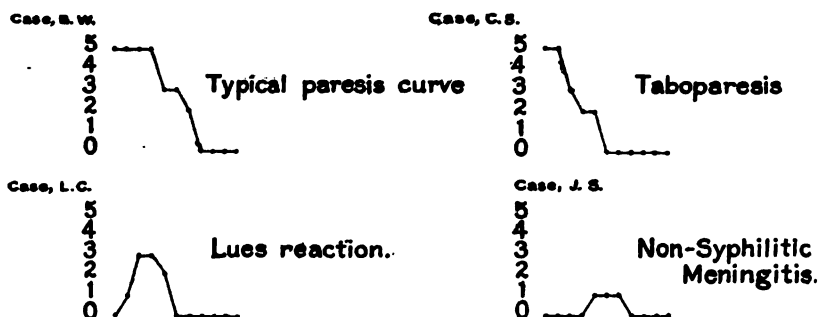
3. Proteins in the presence of an electrolyte inhibit precipitation in colloidal gold chloride solutions—the so-called “gold-Schutz.”

4. The relation existing between this opposed reaction of electrolyte and protein is definite for the same protein, but differed when a different protein was used, and is, therefore, a specific property of the individual protein.

Lange,⁸ in 1912, attempted to apply this gold protection method to the study of the proteins of the cerebrospinal fluid. Instead of securing protection, as he had hoped, the reverse occurred when a large amount of protein was present. He also observed that precipitation or color changes occurred at definite dilutions. This point seemed specific for definite conditions. In this way a method of differentiation between syphilitic and non-syphilitic conditions was found. Moreover, when cerebrospinal fluid, in the presence of a 0.4 per cent. sodium chloride solution, was added to a definite amount of a colloidal gold solution color changes occurred. Cerebrospinal fluid from cases of tabes reacted almost as characteristically, but fluids from cases other than syphilis gave no color changes at all, or less reactions and at lower dilutions.

The technic of setting up the tubes as is used by Lange⁸ and others^{9, 10, 11} is as follows: Into each of ten sterile, chemically clean test-tubes 1 Cc. of a 0.4 per cent. solution of sodium chloride is added to hold the globulins and nucleoproteins in solution. Into the first tube are then added 0.2 Cc. of the cerebrospinal fluid to be examined and 0.8 Cc. of the sodium chloride solution. This makes 2 Cc. of solution in the first tube and 1 Cc. in each of the other tubes. After thoroughly mixing, 1 Cc. of the contents of the first tube is removed and is added to the second tube, which now contains 2 Cc. From the second tube 1 Cc. is now taken and is added to the third tube. This method is repeated until the tenth tube, when the 1 Cc. is removed and thrown away. In each tube there is now 1 Cc. of cerebrospinal fluid in 0.4 per cent. sodium chloride solution in the dilutions of 1 to 10, 1 to 20, 1 to 40 up to 1 to 5120. Into each tube

are now added 5 Cc. of the colloidal gold chloride solution and the tubes immediately shaken. A control tube may be used containing no cerebrospinal fluid. In pathologic fluids definite color changes will be observed in a few minutes, but a final reading should not be made until after twelve or more hours have elapsed. Normal fluids show no color changes. The color changes which occur in pathologic fluids are: 5, colorless; 4, pale or gray-blue; 3, blue; 2, purple or lilac; 1, red-blue or a color slightly different from the original color; 0, red or no change from the control. Reactions with pathologic fluids may be expressed diagrammatically thus:



The following should be adhered to strictly in the performance of this test:

1. Only high grades of chemicals should be used.
2. Fresh doubly-distilled water must be used everywhere, and must be used within a few hours after the final distillation.
3. All solutions must be made with the above-described water. The sodium chloride solution must be made within two weeks of the time it is to be used.
4. No rubber attachments should be used in the distilling apparatus.
5. Pipettes should be cleansed with water, alcohol, ether, and dry sterilized.
6. There must be accuracy in all measurements.
7. Needles used for the lumbar puncture should be cleansed with alcohol and ether and dry sterilized.
8. Bacterial or blood contamination must be avoided.
9. The colloidal gold chloride solution must be brilliant red, trans-

parent, and free from any traces of blue, and no coagulum or deposit must occur.

10. Readings must be made in the proper light and with a suitable background. Artificial light may give misleading readings.

11. The technic of preparing the colloidal gold chloride solution may be had by referring to any of the recent articles upon the gold chloride reaction.^{6, 8, 9, 10, 11}

The colloidal gold reaction is one of our most valuable tests in the examination of the cerebrospinal fluid. The reaction is particularly useful in differentiating incipient general paresis and neurosyphilitic disturbances in a syphilitic. In general paresis there is a distinct curve, which is known as the paresis curve. A typical example of this curve is seen in Plate IV. In tabes the reaction is not quite so characteristic and is present less frequently. The reaction is more delicate than the blood or fluid Wassermann, the cell count, or the globulin content. It is nearly constant in syphilis of the central nervous system; it is extremely sensitive and is reliable when positive; the amount of fluid used is quite small (0.2 Cc.); definite conclusions are reached with ease and rapidity; the margin of error is exceedingly small; it runs parallel with the Nonne and Noguchi and bears relationship to the Wassermann reaction, which is constant. The chief advantages in this reaction are the small amount of fluid used, its technical simplicity, the sharpness of the reaction, and its delicacy. It differentiates spinal fluids due to other causes than syphilis. "The reaction peculiar to paresis is sufficiently constant to warrant its use as an aid in the differentiation of this condition from others with which it might be confused. The statement that they indicate the earliest stages of the central nervous system involvement lacks proof."¹¹ Normal fluids give normal reactions. An error in technic usually gives negative reactions. This fact makes the positive reaction much more conclusive.

GENERAL SUMMARY AND CONCLUSIONS

The conclusions which follow are based upon a study of the cerebrospinal fluid examinations made at the Pathological Laboratory of the Rochester General Hospital and from the apparent consensus of opinion as expressed by the recent writers on spinal fluid examinations.

In the cerebrospinal fluid not too much should be expected. In only a few instances can absolute determinations be reached. The finding of the tubercle bacillus or the pneumococcus is the occasional high light in routine study of the cerebrospinal fluid. A positive globulin reaction does not mean any specific nervous disease any more than does a leucocytosis mean pneumonia or the finding of a small amount of albumin in the urine make a diagnosis of interstitial nephritis. Real significance of these findings in differential diagnosis becomes apparent only when the absence or presence of these tests is carefully construed with a full knowledge of all the clinical facts in the case.

Properly to appreciate the diagnostic value of the study of spinal fluids it is necessary to remember that the spinal fluid is, in a diagnostic sense, analogous to the blood, and, as in the blood, only a few tests of absolute value are known, so in the interpretation of the examination of the cerebrospinal fluid most of the knowledge obtained is relative. The globulin reaction and cell count tell us that we are dealing with a pathologic fluid, but it remains for the bacterial findings, the Wassermann and gold chloride reactions, and the clinical evidence to classify the pathologic disturbances. Absence of findings indicative of meningeal reaction in a single examination cannot be taken as conclusive evidence of freedom from central nervous involvement. Positive findings always mean organic disease, while negative findings, like most negative findings, are not of equal value in absolutely excluding organic disease.

A complete examination of the cerebrospinal fluid should be made in every case of nervous or mental disturbance where there is some doubt with regard to the diagnosis. If the Wassermann reaction is negative and all other findings are positive and the clinical history suggests syphilis, antisyphilitic treatment should be instigated.

The greatest value in an examination of the cerebrospinal fluid in doubtful cases is its use as a means of differentiating between functional and organic affections of the central nervous system, as a guide to therapy, and in deciding when to terminate treatment after the complete disappearance of all clinical manifestations.

In borderland cases a number of tests should be used on the fluid, and if still in doubt the examination should be repeated at a later date on fresh fluid. A borderland result, in the hands of a physician

who does not know how to weigh laboratory reports, will sometimes be provocative of error if too much credence is given such report. If careful technic is used and the proper interpretation is given to the findings, the value of the examination of the cerebrospinal fluid, although not always absolutely conclusive, in diagnosis in doubtful nervous cases can scarcely be overestimated.

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THE DIAGNOSIS AND TREATMENT OF ARTERIO-SCLEROSIS

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ARTERIOSCLEROSIS represents but one link in a chain of fibroid changes, resulting usually from some form of toxic irritation. The allied organs principally involved in these sclerotic changes are the kidneys, lungs, stomach, and prostate. Secondary structural results may arise, as shown in atheroma with calcareous deposition, gangrene of extremities, cerebral, retinal, or other hemorrhage, thrombosis, cerebral atrophy, and myocarditis.

Increasing blood-pressure and arteriosclerosis are abnormal (although frequently present) at any period in life, however late, and quite as abnormal as is interstitial nephritis. In healthy people a slight decrease in blood-pressure occurs after the period of greatest vitality and activity has passed. The preorganic stage or that of hypertension only, frequently covering a considerable period of years, is the stage of greatest importance, for during it not merely arrest but complete recovery may readily be obtained.

ETIOLOGY

Death claims its majority, either directly or indirectly, by the way of arteriosclerosis. Its causes are both through hereditary tendencies and acquired conditions. Families who in one generation after another violate to excess the normal functional latitude of one or more of their organs, whether it be through accumulation of poisons, excessive nervous expenditure, or otherwise, must necessarily transmit a defective inertia relative to the loss of such force in their own possession. Much more important, however, in this condition, is the use made of what one has, rather than the quality of what he inherits, for, generally speaking, acquired causes are conspicuously responsible.

Lead and specific disease (acting directly on the arterial walls), uræmic and diabetic products are capable of developing rapidly ex-

tensive atheroma. The less active: pyæmia, influenza, typhoid and other bacterial poisons, various altered internal secretions (of the adrenals, pituitary body, etc.), acid intoxication of muscular fatigue, and certain drugs later referred to, are capable of producing and maintaining hypertension. Under favorable conditions, also, various reflex sources of local irritation, especially if accompanied by much pain: pelvic disturbances, joint affections, falling and painful foot arches, intracranial irritation, increased cardiac action due to local abnormalities (*e.g.*, early valvular aneurism) and those more of the obstructive nature (acting in part through suppressed metabolism): hepatic cirrhosis, nephritis, existing sclerosis of splanchnic vessels or of the aorta, either by direct vasomotor contraction or indirectly through digestive disturbances, are capable of aiding in the production of hypertension.

Predominating, clinically at all events, and largely dependent upon the nervous status influenced by excessive or unnatural mental fatigue long continued, as shown in those subjected to worry, severe suspense and anxiety, the most important immediate cause of hypertension is directly due to bacterial activity in the gastro-intestinal tract with the excessive development and absorption of organic acids produced from carbohydrate disintegration (which have been shown also to lead to other fibroid or cirrhotic changes), bodies of the neurine and muscarine type, but principally of the aromatic nitrogenous derivatives, indol, skatol, etc., after the liver-cells have become overloaded. This latter condition leads to inefficient oxidation into the normal end-product, urea.

Last of all, the age factor (involution) cannot be ignored, because of its inevitable effect upon normal tissue elasticity. However, in health the lack of elasticity is more than compensated for by the decreased energy and heart action of advancing age, so that normally a decrease and not an increase in blood-pressure occurs.

In summing up as important among the daily causes of arteriosclerosis should be remembered the greatest underlying and undermining influence, that of the unstableness of overfatigued nervous centres, as a result of which imperfect digestion occurs and the resisting powers, not of the intestinal mucosa alone, but of the hepatic and other glandular functions as well, become relatively incapable of withstanding usual or added exciting causes. These exciting causes

are principally relative excess of food habitually taken, especially of proteids, animal fats and sweets, of tobacco, the steady use of stimulants in excessive or in more than minimum quantities, shallow breathing which permits of insufficient surface for complete oxygenation, habitually insufficient sleep, not drinking enough water to assist digestion by exciting gastric juices or to aid in elimination, insufficient daily exercise leading to an excess of unused albumin because of muscular inactivity, and to suboxidation, resulting in a surplus of intake as well as a surplus of retention.

These conditions, like the gouty and rheumatic, keep up one of altered chemical irritation and more or less storing up within the various glands, in abnormal quantity and quality, of substances which may only periodically be liberated into the circulation in quantities sufficiently large to produce other marked symptoms, but constantly sufficient to produce arterial contraction. Further, the existent systemic absorption in intestinal toxæmia is relative, dependent not alone upon the quantity or quality of decomposition product within the intestine, but very largely upon the tissue vitality or lines of resistance which influence both the absorption and the neutralization of the absorbed substances.

From some combination of these common causes the foundation is established from which gastro-intestinal toxæmia, rheumatism, gout or other suppressed metabolic state, or several in conjunction, may arise (though years may pass before the trouble becomes evident to the individual), leading to hypertension.

Whatever may be the cause for establishing hypertension, the latter is to some extent automatically maintained through the counter-recoil of the musculo-elastic arterial walls against the unnatural force exerted within them, leading to arteriosclerosis and even atheroma with calcification.

The action of certain drugs and toxins is of special interest in this connection, and, indeed, of practical etiologic significance. Some of these act principally and directly upon the unstriated muscle of the arterioles, others chiefly or wholly upon the heart muscle, while still others exert their influence through the nerve-centres.

Of those acting mainly and directly on the arteriole, adrenalin, nicotine, barium chloride, and ergot are the most decided (affecting the heart muscle less).

Digitalis and its congeners (especially within the kidneys), phrynin, caffeine, with other purin bodies, and apparently the colon bacillus, while directly stimulating the arterioles, exercise their greater influence upon the heart muscle, the latter in addition being stimulated by the glucosides, strophanthus, etc.

Through the nerve-centres cardiovascular stimulation is also induced by strychnine, purin bodies, digitalis, and nicotine. Nicotine and alcohol, if taken in large doses, lead to paralysis and dilatation. This is also true of muscarine and tuberculin, while adrenalin causes pancreatic vasodilatation.

From tobacco smoke a relatively small amount of nicotine in combination with a large proportion of pyridine and picoline bases is absorbed.

PATHOLOGIC

The pathologic changes which take place in the structure of the arteries and kidneys in this connection develop only after the functional disturbances therein have existed for a considerable length of time. Eventually the arterial walls, either locally or generally, undergo fibrosis, in part as a result of the lowered nutrition to their walls and inaction of the muscular coat because of its continuous state of spasm. Arteriosclerosis in certain cases may thus develop from hypertension without any primary injury or inflammation—no endarteritis—while in others there appears to be an initial inflammatory thickening of the intima due to infective or toxic agents. The former changes result from physiologic stimulation and strain, with the laying down of fibrous tissue in place of the gradually-decreasing muscle and elastic tissue. Such is the case in the usual patchy fibrosis type of the aortic intima, as pointed out by Adami.

The localized bulging outward of the media, especially at the points weakened by branch arteries (*e.g.*, intercostal), may be followed by a form of fatty degeneration. Because of the better nourishment of the intima it endeavors to compensate for this loss of support by an overgrowth of fibrous tissue. Normally and during the early stages of fibrosis the intima and inner layer of the media contain no nutrient vessels, being nourished directly by the main blood current. As the condition progresses increase of the fibrous tissue layers takes place in the intima between its inner and outer zones, filling the

area of distention, until within the central portion of this fibrous growth begins a process of degeneration, owing to its failing nourishment. Such, though usually beginning at points of greatest strain, extends to the smaller arteries as the rigidity in the larger develops. Should the above process continue, calcareous deposits may later take place in the necrosed areas of the media and intima. Such changes are particularly liable to occur in the coronary arteries to the heart muscle, the first portion of the aorta, the splanchnic vessels, and, to a lesser extent, in the terminal arteries of the brain, especially around the fissure of Rolando. Peri-arterial fibrosis, in senile cases, whether primary or secondary, is a prominent pathologic condition. These weak links in the circulatory chain may be able, under favorable conditions, to withstand the strain for a considerable period, but, as a rule (especially if there is much atheroma), hemorrhage sooner or later occurs, unless the pressure be relieved. In the absence of treatment the pressure may become lowered as a result of fatty degeneration and stretching of the heart muscle, because of the poor nutrition to its substance, succeeding the stage of hypertrophy. Instead of hemorrhage, thrombosis, with or without embolism, may occur.

Following closely upon, or often preceding or accompanying, the arterial changes, the renal fibrosis resulting in chronic interstitial nephritis usually develops.

The pathologic findings in cases of angina pectoris have not been in accord with the clinical theory that the pain is necessarily dependent upon atheroma of the coronary arteries. Persons suffering from typical angina attacks frequently fail to show on post-mortem any lesion in these vessels, while those never having suffered from angina pectoris frequently show extensive coronary lesions and even obliteration of an artery.

Manoélian has called attention to the existence of numerous nervous centres in the posterior cardiac plexus. It is composed of a rich anastomosis of nerve filaments and of ganglia made up of sympathetic cells. In addition, he found solitary nerve-cells of the sympathetic type in the connective tissue of the middle coat of the aorta. From the connective tissue nerve-fibres ran towards the elastic fibres and the smooth muscle cells, where they terminated either in a rounded, knob-like swelling or in a finely-drawn-out end. What simulated the motor plates of striated muscle were close to the smooth

muscle cells. The connective tissue of the middle coat was found richly innervated, and a large number of nerve-fibres ended here. Manoélian believed these nerve-fibres to be sensory in function, making it possible and probable that a reflex vasomotor arc exists.

These findings strongly support those of Vaquez, by which the latter concluded that any accidental increase of pressure distending an already diseased aorta would bring about anginal attacks. Further aortitis and peri-aortitis are almost always present in cases of angina pectoris.

SYMPTOMS

Symptoms (of which there may be none or many), when one or more of importance be present, suggesting the need for a thorough examination of the circulation and for the condition so frequently associated with it, intestinal toxæmia, are: hypersensitive nervous system with neuralgic points and various nerve and tissue pains, throbbing headaches, especially at the temples or base, with grating sensation, cranial pressure, photophobia, mental depression, or general feeling of stiffness or aching with lassitude, these occurring especially when toxæmia also exists. Later, transient aphasia, hemiplegia or monoplegia, and, of great importance, mental enfeeblement—as shown by incapability to concentrate, poor memory for recent events, loss of words, uncertainty of thought and speech, pain or distress through upper part of chest upon sudden exertion or excitement or after a hearty meal, vertigo, auditory pulsation, dyspnoea, and fainting spells. Lameness increasing with fatigue—even to loss of power with numbness in the legs, with or without pain—is a very important symptom, as are also pyorrhœa, emphysema, and persistent bronchial disturbances.

DIAGNOSIS

The diagnosis of arteriosclerosis requires much detailed care. Hypertension does not mean arteriosclerosis any more than a low blood-pressure means the absence of arteriosclerosis. Arteriosclerosis, while usually capable of direct recognition, may in other cases be so obscure that a diagnosis made by deduction will be all that can be obtained. Even when the radial, temporal, and other superficial arteries do not show the physical signs of sclerotic changes, nor the skiagraphic appearance of the leg arteries, but when in middle-aged

and older persons the renal secretion shows such changes in these organs (increased quantity voided, hyaline casts, occasional traces of albumin or granular casts), along with either a general lowering in vitality as shown by skin, nails, peripheral arteriole inaction, precordial pains, or claudication with or without cramps and pain, especially if accompanied by evidences of myocarditis or gastric sclerosis, sclerotic changes in the arteries should be strongly suspected.

In the majority of cases, however, there will also be one or more of the following signs: hypertension or physical evidence in the arteries, as beading, tortuosity, twitching, whipcord condition, or palpation of radial artery below a point of firm pressure. In typical conditions skiagraphic evidences, changes in the superficial arteries, cardiac hypertrophy or dilatation (frequently showing myocarditis), arteriole fixation, and the relative difference between systolic and diastolic sphygmomanometer readings will be present.

Symptoms and physical signs must be carefully analyzed: mere sphygmomanometer reading is not sufficient in determining arterial condition. A low reading may be present in advanced arteriosclerosis as a result of failing compensation. A relatively high reading, usually without evidence of cardiac enlargement, may exist in association with fatty right ventricle or myocardial degeneration and small blood volume with atheromatous arteries, because of the latter requiring slightly greater force to compress their walls (if atheromatous at point of compression) without proportionate intra-arterial pressure.

Slight variations in blood-pressure occur in health accompanying brief physical exertion, active digestion, and following stimulants and tobacco. Marked increase also results from certain acute sthenic diseases.

Systolic pressure estimation is of value for recording maximum strain upon heart or atheromatous arteries, but diastolic pressure representing the constant element in blood-pressure is of greater importance, recording the constant arterial load, and, because of its influence upon the blood supply to the vessel walls, especially in the lower limbs. With a low diastolic pressure there is less danger of arterial rupture, even though the systolic pressure be high.

The aortic diastolic pressure representing the strain which the aortic valves are subjected to is of much importance, as seen in aortic

incompetence or in "athlete's heart." It also represents the resistance to be overcome by the left ventricle during the beginning of systole. It gauges largely, too, the peripheral resistance, but with increasing inelasticity of arteries there necessarily must be a relatively higher systolic pressure and lower diastolic pressure (because of less dilatation and less recoil to maintain the diastolic), thus disguising the otherwise high diastolic pressure reading of increased peripheral resistance. Great importance, therefore, is to be attached to a high diastolic reading when accompanied by a fairly slow heart-beat and inelastic arteries, as indicating a greatly-increased peripheral. The diastolic pressure is also increased by rapid heart action, not giving time for pressure to fall during diastole,—in other words, time for capillary circulation. A diminished pulse-pressure, —i.e., a high diastolic with a relatively low systolic pressure, with moderate heart-rate and aortic competency,—indicates a slow or poor capillary circulation.

The extensive range between systolic and diastolic pressure in such conditions as aortic regurgitation, shock, etc., cannot be regarded as true pulse-pressure readings, as it does not represent the extent of capillary circulation. As a rule, the amount of urine, urea, and chlorides is directly in proportion with the extent of pulse-pressure, while in nephritis the albumin varies inversely with it.

The auditory method of estimating blood-pressure is becoming more generally accepted as the more reliable. By using a tambour attached to a separate band on the distal side of the armlet, avoiding undue pressure upon the artery, and raising the armlet pressure above the systolic pressure, then releasing the armlet pressure until the pulse again passes beneath the armlet, the *systolic pressure sound* is heard (i.e., the *first* of the thud), and if the technic is accurate this sound will invariably be heard as early as, and usually before, the pulse may be felt by the finger. Now if the armlet pressure be further lessened the sound becomes louder with some murmur. Still lower the sound becomes suddenly weak and dull in quality, *indicating* at this point the diastolic pressure as worked out by MacWilliam and Melvin. This may shortly be followed by disappearance of the sound (especially in inelastic arteries), or the sound may persist to a much lower reading, as in young adults.

In some cases the armlet pressure made upon the artery tem-

porarily lowers its diastolic reading, and for this reason a comparison of a diastolic reading as taken above with a reading taken on the armlet pressure rise may show much difference, and here the latter is more accurate. The difference corresponds to the degree of arterial inelasticity.

Normal systolic pressure by the auditory method in the adult averages 115 mm. mercury. Normal diastolic pressure averages 75 mm. Normal pulse-pressure averages 40 mm.

TREATMENT

The treatment of arteriosclerosis in the past has been palliative and expectant, treating symptoms as they might arise, but without hope of eradicating or materially lessening the abnormal processes. During recent years, as a result of the rapid development in a better understanding of the *modus operandi* of various physical measures (especially electrotherapeutic, the rapidity of which has not been excelled, either in character or importance, by any other use of electricity), the treatment of arteriosclerosis has been raised from one of hopelessness to one of scientific usefulness in the saving of life and the eradication or arrest, not alone of cause but of result, in the majority of cases and with marked relief to those far advanced.

Treatment of arteriosclerosis must necessarily be considered under different headings: preventative and remedial, as influenced by the cause if still existent, the extent of the disease, and its association with other conditions. In most cases the management of causes is separate and different from that of the arterial condition itself, yet the influence of the treatment directed especially at the arterial state acts so profoundly upon the general metabolism that certain of the causes are, in part at least, influenced by some modification of it, as will be seen later. Therefore the general treatment may first be taken up and followed by special attention to special conditions.

In addition to the hygienic regulation of living, so small a percentage of total benefit is obtained from the use of medicinal remedies, with temporary and irregular lowering of blood-pressure, and only at the expense of cardiac depression and disturbed compensatory circulation, that the use of such agents is rapidly becoming extremely limited.

These drugs, veratrum viride, aconite, chloral hydrate, and the

iodides, weaken the heart muscle and produce anæmia and digestive disturbances. In order to repair such damage done they are followed by strychnine, digitalis and its group, strophanthus, caffeine, etc. These in turn rapidly raise the blood-pressure again, in part through arteriole contraction, so increasing the heart's work often out of proportion to its muscular ability and thus giving rise to a fluctuating blood-pressure with failing compensation which serves to keep the fatal pendulum swinging from one direction to the other. Out of these consequences has grown the impression that hypertension should not be lowered or disturbed, and this is probably as safe a general rule to follow, so far as drugs are concerned.

While nitrites are, *per se*, of great value in emergency conditions, their effect is so temporary and varying that they compare most unfavorably with physical measures. In contrast to drug therapy, it has become a recognized certainty that such treatment as will directly be outlined is incapable of depressing or injuring the heart muscle upon which it has no direct action (in such doses), reducing the blood-pressure only by its action on the arterial portion of the vascular system with a minimum of fluctuation. Hence, too low a blood-pressure, heart depression, and hemorrhage (the conspicuous dangers and results in drug therapy) may be entirely obviated by rational physical treatment.

The use of rapidly-varying temperatures and overstimulating or depressing baths, upright high-temperature light-cabinets, in treatments which often demand much circulatory reaction during forced relaxation, either by their nature or the conditions under which they are administered (such as activity or upright position before circulatory readjustment becomes established), exact too large a percentage of serious result (especially where atheroma exists) without compensatory reward.

Certain physical measures, including the high-frequency currents, produce what may be termed active tissue gymnastics without direct chemical or electrolytic change. Such tissue activity, however, involves proportionate oxidation and consequently produces relatively normal metabolism and improved tone. Other physical modalities, by their electrolytic or other physiochemical action, aid in promoting absorptive changes with increased elimination of local products, while

still other means are available for glandular activity and extensive elimination.

It should and must be clearly recognized that in order to obtain good results through the application of physical measures a careful diagnosis of conditions, selection of properly-constructed apparatus, proper modality, and correctly-applied technic be followed. There can be nothing more certain than the failure resulting from partial treatment because of inaccurate or incomplete details in diagnosis. With drug treatment in sclerosis the details of diagnosis are not so essential, because it will not so materially alter the treatment or its results, but to undertake this line of physical treatment with a defective knowledge of the case in detail can only be rewarded by failure.

Nothing is more disappointing than the attempt to obtain good results from an imperfectly constructed or adjusted apparatus. By no means are all of the instruments on the market and in use for this purpose of equal value. Even one of good make will not give good results unless the accessories are properly adjusted. This requires personal attention, with modifications for each patient, in order to obtain the best results.

Many patients with hypertension receive only the most temporary benefit, and frequently no benefit, but instead depression, because of an imperfect machine or technic, and when the same patients are given the benefit of proper technic they immediately and continuously improve. There is nothing surer than the failure resulting from treatment which will follow the use of indiscriminate physical modalities. With all the above requirements perfected, there is still nothing more essential than a knowledge based upon intelligent understanding and experience, giving the operator reasonable accuracy in the application of technic.

PREVENTATIVE OR EARLY TREATMENT.

Preventative treatment, or that of hypertension and associated causes before structural changes have occurred, consists essentially in removing the causes and restoring normal metabolism. In very early and slight cases attention to the mental source and hygienic conditions, with prolonged rest or variety, may suffice where the over-taxed nervous system is principally at fault, but such cases form so small a percentage of those applying for treatment as to make their

number almost negligible. In more advanced conditions, in addition to removal of cause, the treatment of the arteries resolves itself into a means whereby the tissue spasm may be permanently relaxed to a point of restoring a physiologic balance and bringing about normal circulation, including that of the vasa vasorum.

There are several ways by which this may be accomplished. *Auto-condensation* is recognized as the most desirable. The dosage, which varies with conditions, gives most satisfactory results when used as described by Dr. de Kraft, as follows: With the patient upon either de Kraft's fibre chair (which closely follows the contour of the back and legs) or a metal-covered chair with two or two and a half inches of felt over it, or other heavy dielectric, such as a thick-glass-top table, connected to the outer coating of the Leyden jar on one side of the transformer, his hands in contact with metal hand-pieces attached to the outer coating of the opposite Leyden jar through the meter, and the soles of the feet resting upon a metal plate connected to the rheophore from the hands, or with other suitable contact modified for special indications, approximately 1500 milliampères of current are usually given when a Wappler transformer is used. In some cases much less may be sufficient.

The strength and duration of treatment are governed by the time required to produce a physiologic reaction: softening of pulse with a sensation of general warmth, flushing, relaxation, and rest; actual flushing of face and dilatation of blood-vessels of hands. There may or may not be free perspiration. The time required varies. It may be ten minutes in one case and forty or fifty minutes in another.

Instead of using the usual connection to Leyden jars only, in this method, the meter may be connected to the Oudin and the patient's metallic connection made with the opposite side of meter, the other jar being connected to a metal plate under a *thick* dielectric. This treatment should be repeated daily, or less frequently, according to severity, for days or weeks, until the peripheral dilatation which is accompanied by increasing elasticity becomes established. In this way will be brought about a gradual diminution of the excessive tension and at the same time a lessening of the heart's work, accompanied by increased tone in the latter organ until compensation is restored with improved renal function, metabolism, etc. Treatment

as above described will not reduce the blood-pressure below the point of compensation.

Autocondensation given in this way does not depress the cardiac muscle. On the contrary, the peripheral relaxation and improved pulse-pressure, being the only means through which the relief from hypertension is brought about, make it possible for complete cardiac systole and more normal diastole and insure rapid recovery of partially-lost cardiac tone.

When desirable to obtain a greater amount of increased temperature in a patient, it can best be accomplished by connecting the fibre foot-piece to the back of the chair, while the patient's bared feet rest upon the foot-piece, his hands in contact with the hand-pieces.

After the use of autocondensation, when much heat is produced within the body, the patient, while insulated, may be connected to the negative side of a static machine, moving the brush discharge electrode at a considerable distance from the patient all over the body, thus producing a cooling effect and just short of a true brush discharge. In this way the oxidation processes are much increased.

Much care and close observation of patient must be given in applying an electrode over the hypogastrium when administering autocondensation or thermopenetration, as sudden splanchnic dilatation may occur with alarming symptoms, especially in advanced atheroma with intestinal toxæmia. To avoid this, use metal plates of not less than two hundred square inches each and a very high frequency.

Important results of such treatment, amply demonstrated both experimentally and clinically, are: arteriole dilatation, improved pulse-pressure, relief from venous stasis, and better oxidation,—in brief, diminished peripheral resistance with improved nutrition. As a consequence, the high blood-pressure, otherwise necessary for compensatory purposes, is no longer required, a more normal compensation having become established. In this way the harmful results upon nutrition of the blood-vessels because of intravascular pressure lessen or cease.

USUAL OR ADVANCED CONDITIONS AND CAUSES.

In stubborn conditions or those accompanied by extreme lowering of vitality, suppressed metabolism, and elimination, the additional use of the *oven-bath* is of the utmost value. It can in no sense sup-

plant the action of the currents, but as an adjunct it makes it possible to use much larger doses of them without the unpleasant and even serious development of increased toxæmic symptoms which arise from the large quantities of oxidized waste matter thrown into the circulatory channels by the d'Arsonval and resonator effleuve treatment, which in this class of cases may far exceed the accompanying elimination. As a result of this, much more progress can be made and valuable time saved, *especially in urgent conditions with complications*. The importance of this can scarcely be overestimated.

The oven-bath accomplishes all that is useful in a febrile temperature elevation, and, in addition to such oxidation, establishes means for the escape of the oxidized product by stimulation of glandular tissue, as pathologic febrile elevations cannot do. Such treatment, properly given, has a profound reflex effect upon glandular metabolism, enormously increasing the possibilities for elimination.

Special equipment is necessary in order to make the oven-bath safe and efficient in this class of cases. A description of such technic as elsewhere described is too extensive for this paper. Temperature exceeding 400° F. and absolute inaction on the part of the patient, who must remain in the horizontal position for upwards of five hours, are vitally essential factors.

Other benefits resulting from the oven-bath, as from d'Arsonvalization, are: arteriole dilatation, increased pulse-pressure, diuresis, improved digestion and assimilation, chiefly through replacing the venous stasis and detritus by arterial blood, and by reflex stimulation through the nervous system. It is also highly important to maintain a state of thorough portal and intestinal cleanliness throughout.

Venesection is a useful means of reducing blood-pressure in suitable cases (plethoric, sthenic, and urgent), and may prevent hemorrhage or save life. Occasionally a period of lowered tension follows thorough venesection for weeks or months, during which time, if the cause be removed, a more or less normal result may be established. Physical treatment as outlined here, however, accomplishes all the benefit derived from venesection in these cases, does it more rationally and completely, and is under perfect control. It also succeeds where venesection fails.

Clinically it would seem that *gastric disturbances*, as such, have relatively little *direct* causative influence upon arteriosclerosis. Never-

theless, cases present themselves in whom no other cause is detected, which recover from the arterial conditions upon treatment for such gastric disturbances, particularly catarrhal gastritis, atrophic gastritis, and gastric stasis with pyloric constriction or muscular weakness.

For the removal of retained toxic *débris* and the mucus collecting over night in these cases, morning lavage of the stomach with normal saline solution is clearly indicated and invaluable, leaving the stomach in its healthiest possible state to proceed for the day. In this connection it is obviously but a poor substitute to drink salt water in the morning, which quietly lies in the stomach until in part absorbed, in part gradually expelled into the intestine, and especially because of allowing the toxic matter to precipitate in the saline, only to be mixed with food taken later and hence not lessening the amount of harmful matter carried into the intestine to become a cause in the production of hypertension. Hydrochloric acid given in these cases, in the absence of normal gastric production, will frequently hasten the restoration of normal production and at the same time lessen the degree of intestinal decomposition.

A large metal abdominal electrode covering the pylorus, connected to one end of the d'Arsonval spiral while the patient is in contact with a large dielectric or, better, with a large metal electrode over the dorsal spine, connected to the other end of the spiral, excited by a current of high heating value from a transformer up to 2000 milliamperes or higher, will quickly relieve the venous congestion and spasmodic state of the pylorus (when non-organic), frequently causing hitherto alarming symptoms to entirely disappear. The static wave current over the stomach from a Holtz machine is very valuable for its tonic effect in the above-described conditions.

Intestinal disturbances are of infinitely more direct importance than gastric in the causation of arteriosclerosis. It is of the utmost importance, when possible, that of these irregularities any and all which make for the production of intestinal toxæmia be eradicated. Intestinal antiseptics are here comparatively useless, except for the most temporary relief.

Once the condition has become developed, in which not only bacterial decomposition is excessive, but also portal engorgement, when the overworked liver-cells can no longer continue to return through the biliary channels their repeatedly-absorbed portal vein

poisons, the immediate treatment indicated is removal by thoroughly clearing out the intestinal tract either with castor oil or calomel followed by saline. This temporary relief and useful beginning should be immediately followed by irrigation of the colon as described later.

The production of an active hyperæmia with the consequent lessening of venous stasis and improved arterial flow as brought about by d'Arsonvalization (described under gastric treatment, but with the abdominal plate including the lower part of the liver) promptly relieves hepatic congestion and enables the liver-cells to increase the oxidation and transformation of nitrogenous bodies into urea, thus restoring the normal renal stimulus and preventing the escape into the general circulation and accumulation within the tissues of suboxidized and deleterious material. The static wave current applied directly over the liver and abdomen through a large electrode and with a very long spark-gap here renders excellent assistance.

When constipation exists it must be corrected by some selected means until general treatment may reestablish normal tone. Some cases of atonic constipation respond readily to careful massage, others to vibration, but for permanency the improvement of the general tone is vitally important. The latter is also essential for the eradication of abnormal absorption.

The sinusoidal current is one of the most effective means for reestablishing intestinal tone. It is applied by means of a suitable electrode, about eight by ten inches, over the abdomen, connected to one pole, and an electrode four by seven inches placed either transversely across the lumbar region or vertically extending from the first dorsal vertebra downward. The treatment should be at least of half an hour's duration and as strong as can well be borne.

Another current having similar effect and which may be classed with the sinusoidal is the static resonator effleuve. This must be obtained from a Tesla coil with specially heavy insulation and gallon condensation jars of heavy coating. A large Holtz machine, preferably one of sixteen plates, should be used as a source. A large metal plate electrode connected to one terminal of the Tesla is applied to the abdomen of the patient, who is insulated. A brush or ring electrode connected to the opposite end of the Tesla, with large solenoid interposed, approaches the patient to within eight to

twelve inches. This effleuve should be thoroughly applied from the cervical spine downwards, but especially at the lower angles of the scapulæ and over the cutaneous lumbar branches until hyperæmia occurs.

In this way the abdominal muscles may be caused to contract and relax as completely and rhythmically as desired. By repeating this treatment daily, and later less frequently, striking evidence of improved tone rapidly appears. By the use of one of these currents or a judicious combination with the other factors (selected according to indication) the production of complete contraction and relaxation in the muscle, especially with the sinusoidal, results in thorough emptying of the veins and lymphatics of their exudate and detritus, which, alternating with the fullest possible inflow of fresh arterial blood, rapidly leads to a marked increase in muscular and glandular tone. The intestinal decomposition decreases with improved state of the mucosa and cessation of abnormal absorption or toxæmia.

The colon should be thoroughly irrigated, at first daily, later less frequently, with at least three quarts of normal salt solution, by means of a long colon tube of soft rubber sufficiently flexible to avoid injury to the mucosa, but firm enough to keep it from bending readily upon itself. In this connection it is necessary to keep the tube free from the slightest curve, which can be done by suspending it from one end when not in use. Except in cases where unusual obstruction exists, the tube can be carried up in the colon by any carefully-trained and sensitive hand guiding it, but in troublesome cases it is only possible to reach the colon by one with much experience, and in marked malposition or obstruction this all-important procedure must, of course, be abandoned. Introduction of three or four ounces of a saturated sugar solution in water, with a quarter of a yeast cake added, allowing it to remain in the upper colon for several hours, has proved itself to be of value in changing the culture medium. Diuretic waters and alkaline laxatives must be used only occasionally, because of the irritation produced by them and their inhibiting effect under certain conditions on normal intestinal bacteria.

Skiagraphy indicates that many cases of severe intestinal toxæmia associated with extreme splanchnoptosis where the transverse colon may be down in the pelvis recover, so far as clinical evidence goes, without any marked change in the visceral location, implying

that the functional activity depends less upon displacement than upon other factors.

Chronic interstitial nephritis, when moderate, will yield to the treatment outlined below. Clinical evidence indicates that in the majority of these cases arrest of the disease and restoration of function as a whole take place. In the very far advanced cases decided improvement results.

After paying full attention to all dietetic, hygienic and other therapeutic indications, the particular treatment for the kidneys consists in applying four metal electrodes, each measuring about four by six inches, for persons of average anteroposterior diameter, two at the front and two at the back in such relation to each other that each pair will lie directly in line with a kidney, the object being to focalize the heat within each kidney. In thick abdomens a relatively larger electrode should be used in front without increasing the size of the posterior one. It will be found more practical to give this treatment with the patient lying on his back.

The anterior electrodes are now attached by suitable rheophore connection to the outer coating of the Leyden jar on one side of an efficient transformer, and the posterior electrodes similarly attached to the opposite Leyden jar. These electrodes, as well as the skin in contact with them, must be kept perfectly clean, and undue pressure (as from electrode irregularity, folds, pimples, etc., on the skin) must be avoided in order to prevent annoying burns.

By beginning the treatment with a small amount of current until slight local perspiration occurs, forming good conduction, a general and even contact will soon be established, making it possible to then carry the current up to approximately 2000 to 2400 milliampères. This should be continued for half an hour daily until all granular and epithelial casts, at least *most* of the hyaline and the most minute traces of albumin have disappeared from consecutive twenty-four-hour samples of urine for at least a week.

The number of weeks required by such treatment varies greatly. Average cases do not require more than three or four weeks. Severe cases may require proportionately longer, but all will eventually yield in the most gratifying way, providing there remains a sufficient amount of glandular continuity. The current effect no doubt acts

here as elsewhere, both directly and indirectly, upon the fibrous exudate and tissue, as an absorbent.

The amount of current taken is limited by the sensation of heat to the patient's skin. With proper connections and quality of current 2400 milliampères can usually be borne with comfort, giving a sensation of penetration.

In severe cases the renal hyperæmia so induced should be supplemented by general vascular and glandular flushing as brought about by an oven-bath given either daily or less frequently, according to the degree of suppressed metabolism and elimination. The oven-baths should be continued until the general elimination as shown clinically becomes fully and permanently established. The twenty-four-hour sample variations in urea and increase in total solid output in the urine are very decided, as influenced by the oven-baths, in comparison to the days on which no oven-baths are given. So long as any sub-normal elimination exists the output of the twenty-four hours following an oven-bath shows a marked increase over the twenty-four hours preceding it, when the latter does not shortly follow an oven-bath.

It is quite evident that hypertension may originate from *suppressed metabolism*; for instance, where the purin bodies are not completely converted into urea, as in gout, but where, instead, the suboxidation and faulty fermentation result in the formation of undefined toxic bodies associated with phosphatic production and, later, uric acid and the urates. This condition, however, may not be entirely independent of the digestive derangements.

The general treatment of such conditions is in the main covered by that outlined above for digestive disturbances, the indication being improved metabolism and elimination, which can best be fulfilled through some of the following means as indicated: static resonator effluve, autocondensation, thermopenetration, static wave current, oven-bath, and occasionally the brush discharge. *Non-toxic causes*—local, obstructive, and reflex conditions which are of comparatively infrequent occurrence—are quite as important with regard to their removal.

The results obtained by the described means in the treatment of arteriosclerosis are of a distinctly and highly permanent character, depending upon how thoroughly it may be possible to alleviate causes, and upon the extent of atheroma.

Localized areas of arterial spasm are best treated by static resonator effleuve (as described elsewhere) applied to the spine until the skin becomes thoroughly reddened. As a result reflex stimulation of hepatic and intestinal secretions occurs. This should be followed by the oven-bath or by the static wave current with a large plate applied to the abdomen, using a very long and slow spark.

Occasionally, for one reason or another, a case fails to respond satisfactorily to the usual treatment, but in these cases one will usually be rewarded by selecting some other modality acting along similar physical lines.

FOR ADVANCED AND TERMINAL CONDITIONS.

In the far-advanced cases with marked atheroma, where mental tardiness is so frequently a pronounced symptom, and less often angina pectoris, removal of cause, when present and possible, is important if anything is to be obtained beyond mere alleviation of symptoms and prolongation of a comparatively safe and comfortable existence.

Particularly in cases with mental symptoms, galvanism is often beneficial, applied as follows: Across the forehead place the negative metal electrode, about two inches by six inches, separated from the skin by twelve to sixteen layers of surgical lint wrung out of a three per cent. sodium chloride solution. With the positive electrode similarly applied to the nape of the neck, from five to ten milliamperes and, in exceptional cases, up to twenty milliamperes may be given for from ten to thirty minutes. Especial care must be taken that no sudden change in contact or quantity of current be made, else extremely unpleasant sensations may result to the patient.

In angina pectoris, with a negative electrode over the sternum, separated from the skin by the lint previously soaked in a solution of sodium chloride or sodium salicylate, with the positive electrode similarly prepared and applied from the first to the fifth dorsal spine, using five to ten milliamperes as above, much relief is often obtained.

In advanced conditions of general sclerosis, where only comfort and prolongation of life can be hoped for, much benefit may be derived from moderate (about half) doses of autocondensation, followed by the application to the skin of the abdomen of a large spiral glass electrode excited from the Oudin to 200 or 300 milliamperes

until a decided sensation of warmth is felt, accompanied by hyperæmia.

The technic for the relief of arterial contraction as previously described must be methodically carried out for a longer period, and when a marked suppression of elimination exists the *oven-bath*, with or without the catabolic influence of the static resonator effleuve, has proved itself of inestimable value. It not only prolongs life, but makes it comfortable by its general tissue-relaxing effect, and aiding as no other agent does in promoting rapid elimination, in maintaining peripheral dilatation without producing increase of local blood-pressure at any point or endangering arterial rupture. Instead of the rapid development of a very high temperature for this purpose, a more gradual elevation to about 375° F. is desirable.

The oven-bath produces diuresis, relieves dyspnoea and lividity, and reduces anasarca and œdema. When the oven-bath is not obtainable, a high candle-power incandescent light, including a large proportion of heat rays applied over the body, and, in the case of angina pectoris, applied locally, is of value.

The indications for immediate treatment in *cerebral hemorrhage* are to lower hypertension and maintain the blood-pressure at a point only sufficiently high to keep up an efficient compensatory circulation without undue pressure being brought to bear upon the damaged area. In this way less continued hemorrhage takes place and there is greater possibility for more complete absorption and restoration of function.

As has been demonstrated in a number of cases of apoplexy where it was possible to promptly use autocondensation for lowering the blood-pressure, the maintenance of a practically uniform, constant, and moderate pressure as may be obtained by d'Arsonvalization gives decidedly better results than the fluctuating pressure brought about by nitrites or circulatory depressants. This prominent fact may be due in part also to the more normal capillary circulation resulting from the d'Arsonvalization as compared with the defective capillary circulation resulting from the heart depressants. The treatment of long-standing cases of cerebral hemorrhage is at the best unsatisfactory.

In case of recent *retinal hemorrhage* d'Arsonvalization, when immediately used, is promptly followed by absorption with either com-

plete or almost complete clearing of the vision. When a residue is left, the Röntgen ray is fairly efficient in promoting its absorption.

Without treating the subject of dietary, it may be said that, in general, restriction of the total amount of food taken, especially of the proteid element, meat fats, and sweets, to the least amount compatible with health and energy, substituting a fair proportion of farinaceous lactose-bearing food, makes an appreciable difference in the ease with which a hypertension may be controlled. Of itself it occasionally, though seldom, reduces blood-pressure materially.

To sum up the treatment of arteriosclerosis: First, a correct diagnosis is essential. In the second place, one should utilize every available form of accessory treatment of distinct benefit, including dietetic, hygienic, medicinal, etc. In fact, nothing may be omitted that is of definite value in desperate conditions.

Finally, in order to obtain desired results, physical treatment on the principles outlined above is absolutely essential, and its proper application insures in large percentages comfort, prolongation and saving of life.

SOME NEW PHASES OF EMETINE THERAPY

BY ALFRED S. BURDICK, M.D.

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WHEN Leonard Rogers, of Calcutta, in 1912, took up the suggestion made by Captain Edward B. Vedder, of the United States Army, the preceding year, and demonstrated clinically that emetine hydrochloride has a specific amœbicidal action, he made a discovery of more far-reaching significance than most people seem to imagine. Only one other therapeutic discovery of recent years can rival it in importance—that of salvarsan. Not only has Rogers's experience (as supplemented by that of many other physicians in all parts of the world) demonstrated beyond doubt the specific curative action of emetine in amœbic dysentery and amœbic hepatitis; it has had another effect: it has led to a restudy of this important alkaloid and to its application in a variety of other diseases, with results which have been gratifying and, in some conditions, actually astonishing. It is to some of the later uses that I wish to refer particularly in this short paper.

The Use of Emetine in Hemorrhage.—Nearly a century ago Trousseau recommended the use of ipecac in the treatment of hæmoptysis. For many years this method of treatment has been employed by physicians—in France more than in America. Recalling this fact, Flandin, of Paris, clinical assistant of Professor Chauffard (the first French physician to apply the emetine treatment in dysentery), conceived the idea of trying emetine in hæmoptysis occurring during the course of tuberculosis. It had been observed that blood very rapidly disappeared from the stools of dysenteric patients under emetine treatment, and this also suggested the possible value of this substance in hemorrhagic cases. Flandin's report of experience with emetine in hæmoptysis was published in *Presse Médicale*, September 24, 1913.

The first case treated was that of a man suffering from very profuse tuberculous hemorrhage which had refused to yield to the usual

methods of treatment, such as ice, calcium chloride, serum, etc. A single injection of 0.04 gramme ($\frac{2}{3}$ grain) of emetine hydrochloride caused an abrupt cessation of the hæmoptysis, while there was an accompanying fall of temperature. Other cases were subsequently treated in the same manner by Flandin, in association with Joltrain, and with equally brilliant results. Since then the method has been adopted by a large number of French physicians, including Lesné, Rénon, Léon Bernard and Paraf, and Josué and Belloir. At a meeting of the Société Médicale des Hôpitaux, July 18, 1913, Flandin declared that up to that time he had personally seen twenty cases of hæmoptysis, all of which were successfully controlled with emetine.

This method of treatment was soon adopted by English and American physicians. For instance, Raeburn, writing in the *British Medical Journal* of March 28, 1914, is enthusiastic in praise of emetine, agreeing with Flandin that the results obtained with the drug in hemorrhage from the lungs have been far more satisfactory than those secured by any other remedy or method. "At first," he says, "I strictly confined myself to cases of hemorrhage on the lines that Dr. Flandin had indicated, and with regard to its use in such cases I can endorse all that he claims for it."

Raeburn also declared that not only does it check hemorrhage, but it also serves to arrest the copious expectoration so often observed in tuberculous cases.

While the number of published American reports of the use of emetine in the treatment of hemorrhage from the lungs is relatively small, there have come to the writer through personal sources of information a considerable number of such reports, and thus far these have invariably been favorable. The following communication from Dr. R. S. Irwin, of Denver, Colo., is a fair sample:

"My use of emetine hydrochloride has not been extensive enough to give much data as to the value of this remedy in pulmonary hemorrhage. However, I have used it in eleven cases of hemorrhage with good results; it gradually reduced the amount of blood, while diminishing the cough and lessening the amount of sputum."

It will be noted that Doctor Irwin's observation with regard to the effect of the emetine upon the amount of sputum verifies that of Doctor Raeburn, already cited.

Emetine is also being used successfully in the treatment of other

forms of hemorrhage. One of the first to recommend it was Ramond, who used it successfully in the treatment of hemorrhage occurring during typhoid fever. His comment is that under its use "intestinal hemorrhage ceases as by enchantment." It is proper to add, however, that not all French clinicians have obtained equally favorable results with emetine in the treatment of hemorrhage from this site, although the consensus of opinion is decidedly favorable.

Emetine has also proved very efficacious in the treatment of hemorrhage from other sites. For instance, Dr. James T. Prestley, in the *New York Medical Journal*, reports a case of nose-bleed occurring in a woman of seventy-three, coming on regularly every night for about ten days. One-half grain of emetine hydrochloride, given hypodermically, checked the hemorrhage within twenty minutes, and the result was maintained by one-half grain daily injections for five succeeding days.

There have also been published favorable reports of the use of emetine in the treatment of hemorrhage occurring in hæmatemesis, in the course of Barlow's disease (infantile scurvy), hemorrhagic disease of the new-born, uterine hemorrhage, rectal hemorrhage, hemorrhage from the gums, and from other sites. Dr. Joseph Weinstein, of New York, is using emetine hydrochloride injections to prevent and control the hemorrhage so often found associated with tonsillar operations, and is enthusiastic in its praise. (See *Medical Record*, January 16, 1915.) Dentists are using emetine to arrest hemorrhage following tooth-extraction, and with alleged good results.

The writer is free to confess that, while he may be over-enthusiastic, he has not thus far seen or heard of a single case of hemorrhage in which this drug, promptly used, was a complete failure. The evidence available indicates that emetine is, perhaps, the most generally effective remedy thus far introduced for this purpose, although the test of time is still lacking.

The usual dose of emetine hydrochloride as an antihemorrhagic is from one-half to two-third grain, given hypodermically. According to Flandin—and his observations are verified by other physicians—such a dose of the drug causes almost instantaneous arrest of hemorrhage, and this result is obtained without producing any of the distress, nausea, and vertigo so frequent when the parent drug, ipecac, is administered in large doses. French writers give the warning that

the arrest of hemorrhage is not necessarily permanent, and, to insure the patient against a recurrence, it is advisable to continue treatment with one or more daily injections until the hemorrhagic habit is under control.

Emetine in Respiratory Diseases.—For generations ipecac has been much employed as a nauseant expectorant in the treatment of respiratory diseases. There is now accumulating considerable evidence that the remedy has some beneficent action in this class of diseases aside from that due to its expectorant properties. Just what this action is has not been clearly determined, but Raeburn, Flandin, and others who have studied it believe the remedy has a marked decongestant action.

Rénon, in a paper read before the Société Médicale des Hôpitaux (*Gazette des Hôpitaux*, March 12, 1914), declares that the drug is of great value in the treatment of pneumonia and bronchopneumonia. Under its influence, he declares that, while the disease (lobar pneumonia) is not cut short, the temperature falls, the dyspnoea is reduced, and the whistling râles are rapidly replaced by large subcrepitant râles. The disease usually disappears by lysis. In bronchopneumonia, and especially in old patients, even when the disease is of a severe type, this effect is even more clearly evident than in the lobar type of pneumonia. Again, there is a reduction of dyspnoea, fall of temperature, and greater facility of expectoration. The experience of this writer is in accord with that of Ramond, who has used it with good results in acute and chronic bronchitis.

James A. Raeburn (see *British Medical Journal*, March 28, 1914, p. 703) has particularly studied the action of emetine in pulmonary tuberculosis. He has used the drug in more than forty cases, and has come to some very interesting conclusions. He declares that it usually produces marked reduction of the expectoration, especially in cases in which this is copious, and its influence upon congested and inflammatory conditions of the lungs seems to be a very favorable one. Doctor Raeburn divides his cases into three groups:

First, those of the pretubercular stage,—that is, in which there is bronchitis with no demonstrable tuberculosis. Provided the heart's action is not impaired, the cases of this group nearly always improve rapidly under emetine treatment. The expectoration disappears, and on auscultation the moist sounds cease to be heard. This im-

provement is not transitory, but remains after the injections of emetine are discontinued.

The second class of cases comprises those which are tuberculous but in which the tubercle bacilli are not found in the sputum. All of his patients of this class have improved under emetine treatment. Doctor Raeburn agrees with Doctor Flandin, that in this type the action of the drug is essentially that of a decongestant; in other words, it acts upon the attendant bronchitis rather than upon the tuberculosis *per se*.

The third group includes the cases of a frankly tuberculous type, in which the specific bacilli are found in the sputum. In this class improvement was less uniformly marked than in the preceding two. On the whole, however, the emetine was apparently of value in a considerable percentage of such cases.

One contra-indication to the use of emetine hydrochloride in pulmonary disease, according to Doctor Raeburn, is *weakness of the heart's action*. In these cases the congestion is secondary to the weakened circulation—of the passive type. Doctor Raeburn concludes that the emetine hydrochloride has no specific action upon the tubercle bacillus. It does, however, decidedly reduce congestive conditions in the lungs, and is therefore both a preventive and curative agent in tuberculosis. In these pulmonary cases Doctor Raeburn uses smaller doses than are generally employed for the treatment of hemorrhage.

Pharmacologic Action of Emetine.—There has been much speculation as to the manner in which emetine controls hemorrhage. Flandin and other French physicians who have written much upon the subject assure us that it does not lower blood-pressure nor increase the coagulability of the blood. That it does check hemorrhage, however, is undoubted; but, so far as we have been able to ascertain, Maurel is the first to offer a definite explanation of its mode of action. In a paper read before the French Academy of Medicine, published in the March, 1914, number of the *Bulletin* of the Academy, he advanced the theory that its therapeutic action depends mainly upon the power of the drug to influence the smooth, or unstripped, muscle-fibres. It acts by contraction of these fibres in the blood-vessels, thus causing vasoconstriction.

This theory is based upon a restudy of Claude Bernard's laws

as to the selective action of drugs upon specific tissue elements, and it was worked out after an elaborate series of experiments made upon eels, crawfish, frogs, and rabbits. All the pharmacodynamic properties of emetine, he believes, can be explained through its influence upon unstriated muscle.

In discussing Maurel's paper, Professor Chauffard stated it as his opinion that the action of emetine as a vasoconstrictor must be limited to the capillary system. An objection to Maurel's theory, at least in its application to hemorrhage, is the apparent failure of the drug to influence blood-pressure.

At my suggestion, Mr. Carl Neilsen, pharmacologist to The Abbott Laboratories, has undertaken an elaborate series of experiments relative to the hæmostatic property of emetine. His report appears in the March, 1915, number of the *American Journal of Clinical Medicine*. Mr. Neilsen was able to verify the observations of Flandin and others, that in therapeutic doses emetine does not markedly influence the blood-pressure. Experiments upon dogs show that, as a rule, there is at first a slight reduction of blood-pressure, then an increase to a considerable degree above normal, then in a few minutes a return to normal. There is usually a slight reduction in the rapidity of the heart's action, this becoming more marked with increase of dosage. A very careful series of experiments made by Mr. Neilsen also showed that in therapeutic doses emetine hydrochloride does not influence the physical composition of the blood nor increase its coagulability.

In toxic doses emetine produces increased salivation, nausea, vomiting, slowing of the pulse, and muscular weakness; and in lethal doses, centric paralysis with arrest of the heart in diastole. Vomiting is apparently produced by local gastric irritation.

Apparently Professor Chauffard is at least partially right in his assumption that hemorrhage is controlled through the action of the drug upon capillary circulation. I quote the following interesting report from Mr. Neilsen's record:

"A series of six frogs were anesthetized with ether and the intradigital membrane of the left hind leg stretched out and observed under a microscope. During the entire experiment the membrane was kept moist with Ringer's solution. Five to ten minutes were

allowed to elapse in order to permit the circulation of the blood to become normal and regular.

"The rapidity of the circulation in a series of vessels in a chosen field, as well as the size of the latter, was now closely and carefully observed. Then $\frac{1}{2}$ Cc. of a 1 to 1000 solution of emetine hydrochloride, in physiologic salt solution, was injected into the abdominal lymph sac.

"In all the experiments the same results were obtained: Five minutes after the injection the circulation in the smaller capillaries became slower; in another ten minutes the decrease in the rapidity of the circulation in the smaller capillaries was considerable and that in the larger capillaries noticeable; and during the next thirty minutes the rapidity decreased gradually until it stopped completely in most of the smaller capillaries, and became so slow in the larger capillaries that each blood-corpuscle could be distinctly followed on its course through the vessels. It was also noticeable, without the use of a micromillimetre scale, that the capillary vessels had been contracted. In a few cases the dose was repeated, and this, of course, produced a more rapid effect. The effect lasted a considerable time (more than one hour); thereafter the rapidity of the circulation again increased gradually to normal and all the frogs recovered.

"This experiment is so beautiful that it cannot be too strongly recommended as a demonstration of the effect of emetine."

Emetine in Pyorrhœa.—At the meeting of the Pennsylvania State Dental Society, held in June, 1914, M. T. Barrett and Allen J. Smith (see *Dental Cosmos*, August, 1914) reported the results of some careful investigation into the etiology of pyorrhœa alveolaris (Riggs's disease). These investigations eventuated in their announcement of the discovery of the uniform presence of an amœbic organism in the gums and pericemental tissue obtained from persons suffering from pyorrhœa. In all, forty-six cases were examined, and the organism was found in every one. These amœbæ were subsequently identified as the *Entamœba buccalis*.

These results were subsequently verified by Bass and Johns, of Tulane College of Medicine, New Orleans. The first announcement of their work was published in the October, 1914, number of the *New Orleans Medical and Surgical Journal*, the details being subsequently published in the November number of the same journal.

Several later papers by these gentlemen, and others, have appeared in the *Journal of the American Association*, and elsewhere. Bass and Johns examined 130 cases of pyorrhœa and found the amœba constantly present in nearly all cases of the disease, varying from the earliest to the latest. In only three cases did they fail to find any organisms; in at least one of these there was some doubt as to the identity of the disease. Regarding this organism, Doctor Bass says:

"The amœbæ are easily demonstrated in either fresh or stained specimens. The pus or scrapings from the depth of the lesion should be diluted with a little water or salt solution on a slide, covered with a cover-glass, and examined. Motile amœbæ from about eight to about thirty microns in diameter are usually readily found. An excellent stain is carbol fuchsin, $\frac{1}{4}$ minim, followed by Löffler's methylene blue, $\frac{1}{2}$ minim. In stained specimens, dark-stained objects, apparently the nuclei of pus-cells, can be seen inside the parasites."

In view of the brilliant results obtained by Rogers in the treatment of another amœbic disease, tropical dysentery, through the use of emetine hydrochloride, Barrett began the administration of this remedy in a series of cases, using it at first locally only. Working quite independently, Bass and Johns took up the use of the same drug, but employed it in the main subcutaneously. The results obtained by both investigators were brilliant from the very start. Barrett, for instance, first injected a 1 per cent. solution of emetine hydrochloride in the pockets around the affected teeth, but, as the drug in this strength seemed to produce irritation, he subsequently reduced the solution to one-half per cent. strength. This solution was used to fill the gingival sacs of the affected teeth.

Thirteen individuals were treated with emetine in this manner. In several the pus disappeared completely to gross inspection within twenty-four hours. In every one of the thirteen cases this result was obtained after three daily applications. There was an associated improvement in the local conditions; the tissues took on a more healthy appearance, the teeth became firmer, and the gums settled down more tightly about the roots of the teeth. In none of the cases treated by Doctor Barrett were the amœbæ found after the second or third treatment. Usually apparent cure was obtained after five or six such treatments, although at the time this report was made the

method had not been tried long enough to establish the permanency of cure.

Equally brilliant results were obtained by Bass and Johns, who say: "In more than one hundred cases treated we have found amœbæ constantly absent from the lesions in all except two cases after the patient had been given one-half grain emetine hydrochloride hypodermically daily for three successive days. The tendency to bleed stops in twenty-four to forty-eight hours, and, where only the soft tissue is involved, the red, inflamed gums often appear practically normal in from three to ten days—apparently as quickly as nature can heal them. Where the bony structure is involved and the teeth are loose there are also rapid improvement and relief from soreness and pain. The pus decreases and loose teeth often get firmer in a few days, but it must be remembered that in most cases where the disease has extended thus far the peridental membrane is destroyed to a great extent, often almost to the end of the root. Nature cannot grow new peridental membrane, and retraction must therefore take place to the level of the living membrane. The healing process can be very much hastened by dental treatment, such as scaling, scraping, cleaning, and removing overhanging tissue. It must not be expected that removal of the specific cause and the best dental treatment can save teeth denuded of peridental membrane to the very end of the root and hanging in a suppurating cavity or tooth socket."

It suffices to say that the results obtained by these pioneer investigators have already received what appears to be ample verification in the experience of many physicians and dentists. Reports thus far received from many sources are uniformly good. Such failures as have come to the writer's attention have been mainly due to errors in technic, one of the most common being the use of too strong solutions in the mouth, or the attempt to inject the emetine solution directly into the patient's gums. When this is attempted the reaction often proves very severe. A few failures have been reported, and it is as yet too early to assume that the remedy is specific in all instances.

The method of treatment now usually advised and apparently giving the best results is a combination of that advocated by Barrett and Bass; in other words, the local application of a weak solution of

emetine hydrochloride (one-half per cent. or even less in some cases), together with subcutaneous injections of the emetine. Usually one-half grain of this drug is injected into the arms once daily for three or more successive days, and a similar dose administered every three to ten days, according to the severity of the case and the degree of improvement. It is advised to make the injections first into one arm, then into the other, since there is likely to be some tenderness and occasionally very troublesome itching.

Inasmuch as pyorrhœa is one of the most common diseases known to man, and since it is now known to be an important etiologic factor in the production of a number of serious systemic diseases, including rheumatism, acute and chronic, arthritis deformans, neuritis, pernicious anæmia, and various visceral degenerations, the importance of Barrett's and Smith's discovery cannot be overestimated. If, as now seems to be the case, pyorrhœa is caused by an amœbic organism, and this organism can be definitely destroyed by emetine, then another real specific of extreme value to the race has been added to our too scanty number of really dependable therapeutic weapons.

Emetine in Systemic Diseases.—The importance of the amœbic factor in the etiology of a number of diseases has recently been accentuated by the announcement made by Smith, Middleton, and Barrett in *The Journal of the American Medical Association* (November 14, 1914), that at least some cases of chronic tonsillitis apparently are due to this organism. Pyorrhœa and tonsillitis have both been connected with the etiology of rheumatism. There is a tendency to consider them foci of entrance for an increasing number of infectious organisms. Since emetine will cure or relieve some of the oral conditions which are responsible for systemic ailments, it is reasonable to believe that the same drug may prevent and possibly cure such diseases as acute and subacute rheumatism, arthritis deformans, neuritis, and probably other diseases of amœbic origin. Experience in this field is as yet too small to draw sweeping conclusions, but it is large enough to encourage every physician who is called upon to treat a recurrent arthritic affection, for instance, to make a careful examination of the tonsils and gums, and if these structures are found diseased, and particularly if the *Entamœba buccalis* is found in the mouth, to make faithful therapeutic trial of emetine hydrochloride.

I have not tried to cover the whole subject of emetine therapy. The most brilliant evidence of its specific action, its use in amœbic dysentery and amœbic hepatitis, sprue, and lamblia dysentery, I have not touched upon at all; neither have I referred to its alleged cholagogue action, its possible cathartic action, its questionable value as an emetic, nor to its use in cholera and in typhoid fever. It is enough to emphasize in this paper the value of this promising remedy in hemorrhage, as decongestant in bronchitis, pneumonia, and pulmonary tuberculosis, and as a specific in pyorrhœa alveolaris, and to express the hope that American physicians will give it the careful study which it deserves.

ANIMAL EXTRACTS IN THE TREATMENT OF MEDICAL DISEASES

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THERE is no field of therapeutics in which the results may be more valuable than in the medicinal use of the animal extracts.

Let us take, for instance, the use of thyroid. If in a case of myxœdema, of not too long standing, one administers from ten to fifteen grains of thyroid daily, the health of the patient is, as a rule, in a few weeks apparently restored and remains so as long as the drug is administered. The change for the better is so rapid that one is apt to marvel at the mode of action of the drug. Why does the exhibition of thyroid relieve the symptoms of myxœdema? The answer to this question has been solved by our knowledge of the pathology of the disease; for we know that the manifestations of the affection are caused by hyposecretion of the thyroid gland. In the administration of thyroid extract we simply make up the deficiency, and, so far as we are able to determine, the administration of the drug is just as valuable in the human economy of the patient as receiving it from his own thyroid. This is the best-known use of an animal extract. It is mentioned here merely to illustrate how effective thyroid extract is in the treatment of hypofunction of the thyroid gland.

Let us now inquire as to the therapeutic value of other animal extracts in the treatment of hypofunction of the glands of internal secretion.

There are a number of glands upon which observation has been made. The results have been most unfavorable. But, in order that a more definite statement of the value of the method of treatment may be placed before you, I shall give, in this connection, a brief summary of the subject, including a statement concerning the thyroid.

DISEASES OF THE GLANDS OF INTERNAL SECRETION CHARACTERIZED
BY HYPOFUNCTION, WITH TREATMENT BY ANIMAL EXTRACTS

SUMMARY.—*Thyroid Gland* (Cretinism and myxœdema).—Thyroid extract improves the first and relieves the second so long as the remedy is administered.

Parathyroid Glands.—Removal causes tetany. Tetany in pregnancy is believed to be due to hypofunction. Some observers have reported that parathyroid extract partially relieves the symptoms of tetany.

Hypophysis, or Pituitary Glands.—This is made up of three divisions, viz., anterior, middle, and posterior lobes. Hypofunction of the anterior lobe produces obesity, hyperplasia of the genital organs, headache, and other manifestations of the symptom-complex known as dystrophia adiposa genitalia (Fröhlich's syndrome); in young children hypofunction produces dwarfisms. Extracts of the anterior lobe are ineffective. Pituitrin extracted from the posterior lobe is also ineffectual, but has many pharmacological characters of value.

Suprarenal Glands.—Hypofunction is a marked feature of Addison's disease. Extracts of the gland are ineffective.

Epiphysis Cerebri, or Pineal Gland.—In children hypofunction probably causes overgrowth, obesity, and general precocity. The gland extracts are ineffectual.

Thymus.—This gland normally undergoes involution between the ages of ten and fifteen years. Hypofunction is probably present in marasmus and wasting diseases in young children. Thymus extract is without effect.

Pancreas.—Hypofunction of the islands of Langerhans is present in diabetes. Extracts of the pancreas have practically no effect.

Ovaries.—In children hypofunction produces infantilism; in adults, amenorrhœa and obesity. Oöphorectomy in adults causes symptoms similar to those of the climacteric. Ovarian extracts are probably ineffective, although some physicians report favorable results.

Testicles.—Removal before puberty causes obesity, overgrowth of bone, definite growth of hair on face, etc. Testicular extracts are ineffective.

These observations go to show that, with the exception of thyroid, animal extracts are of little value in correcting hypofunction of the glands of internal secretion. The reason for this is probably that the thyroid is the only gland of internal secretion in which the active principle is stored in any quantity. In all the others the active principles are stored not at all, or only to a slight extent, but pass directly into the blood, in which they are quickly decomposed. Again, thyroid extract is a stable substance, and two or three doses a day are sufficient to supply the human economy of a myxœdematous patient with sufficient active principle for the maintenance of metabolism. It is quite different in the case of adrenalin or pituitrin. The period of activity of adrenalin, given intravenously, is only a few minutes, and that of pituitrin is probably not much longer. It is obvious, therefore, that it is futile to attempt to relieve the symptoms of hypofunction of the pituitary and suprarenal glands by the exhibition of pituitrin and adrenalin, respectively. This is a very important consideration in forming an opinion as to the value of animal extracts in the treatment of disease in general. If a disease is chronic and of such a nature that a more or less continual action of a remedial agent seems necessary to cure it, it is not likely that most of the animal extracts would prove effective.

THE INTERRELATION OF GLANDS OF INTERNAL SECRETION—COMBINED THERAPY WITH ANIMAL EXTRACTS

The data which have been collected from the study of hypofunction and hyperfunction of the glands of internal secretion indicate that the active principles do not act independently, but are inter-related in their functions and modify more or less the physiologic actions of one another.

Thus in hyperthyroidism there is, as a rule, diminished tolerance for sugar, while in hypothyroidism the tolerance is increased. This suggests that the functions of the thyroid and pancreas are, as regards part of their activities at least, antagonistic. Hyperthyroidism is always characterized by irritability of the sympathetic nervous system, which is itself closely related in function to the suprarenals. Again, functional activity of the pancreas is dependent, to a certain extent, upon the activity of the suprarenals. If a large dose of adrenalin is administered to a healthy individual, glycosuria gener-

ally ensues. This indicates a close relationship between the adrenals and pancreas. One might give many other illustrations of the interrelations of glands. All this goes to show the close relationship of the glands of internal secretion. It would appear that in a normal individual the glands form a chain of functional activities. If the function of any link of the chain is materially altered, then the health of the person suffers, not only from the altered function of the individual gland, but also by changes engendered in others.

The interrelation of the glands of internal secretion makes the study of the use of animal extracts in the treatment of disease difficult. It is one of the principal reasons, I think, why so little progress is being made at the present in this field of therapy. Compared to what appears to most of us to be unknown, we know very little about the medicinal use of the animal extracts. We recognize the remarkable action of thyroid extract in cretinism and myxœdema. We have a valuable fund of knowledge concerning thyroid extract, pituitrin, and adrenalin, based on the pharmacologic action of these drugs. But it is probably only a little of what investigators in the future will bring to our aid. The question is: Should we use in an almost empirical manner extracts of the ovaries, testicles, lymphatic glands, liver, and of other glands of the body? Many physicians think we should employ these agents. Some prescribe them individually, while others combine several animal extracts, believing, by so doing, there is greater chance of "striking the mark." The French clinicians are prone to adopt the latter plan.

ANIMAL EXTRACTS IN THE TREATMENT OF FUNCTIONAL NERVOUS DISEASES

During recent years there has been considerable change in our views concerning the pathogenesis of functional diseases. We now recognize that many of the so-called functional nervous disorders are really due to toxic substances. Chorea, for instance, until recently looked upon as a functional disease, is now believed to be caused by the toxins of acute rheumatism. In acute infectious diseases, such as pneumonia and typhoid fever, we may see a great variety of nervous symptoms, such as hallucinations, delusions, tremors, and spasms, which are no doubt of toxic origin. If these manifestations did not occur in the course of a known infectious toxæmia, they would

no doubt be looked upon as functional in origin. Is it, therefore, not probable that many mental states, both in health and disease, have a material origin? If we accept this hypothesis, which appears to me to be rational, then from our knowledge of physiology we look to the glands of internal secretion as one source of the chemical substances (hormones) which effect these changes. We may also blame these structures for inefficiency in protecting the economy from toxins generated in various parts of the body, for we believe that this is one of the functions of glandular secretion, at least of some of the glands. We know that the state of some of the glands has an intimate relationship with the condition of the nervous system and, in particular, of the sympathetic. In Graves's disease the sympathetic nervous system is always in an irritable state, and in the fulminating type of the disease there are marked delirium and other signs of mental disease. On the other hand, in myxœdema there are signs of want of excitability in the sympathetic. Parathyroidectomy frequently results in tetany. Removal of the ovaries or testicles invariably produces mental changes. Among the patients in hospitals for the insane, signs suggesting disturbances of the function of the glands of internal secretion are common. All these facts seem to indicate that animal extracts should be useful in the treatment of functional diseases of the nervous system. At the present, however, our knowledge of glandular secretions is so meagre that we have very little to guide us in their administration in this field of therapy. The most memorable statement which has been made on the subject was that of Brown-Séquard, who, experimenting on himself, found that testicular extract had a most beneficial effect. Brown-Séquard was seventy-two years of age at the time, and, according to his statement, the drug produced a state of mental vigor which he had not experienced for some years. At the time considerable credence was given to the statement. Later it was thought the effect was due to suggestion, which opinion is the one generally accepted at the present time.

The question naturally arises in connection with this statement: What is the nature of the suggestion? Is it possible that the extract did produce transient improvement, and this, by suggestion, led the way to a continuous betterment? I am firmly convinced that this course frequently happens in the cure of disease. Anything which we can do by the exhibition of drugs, by the use of baths, or other

remedial agent which tends to make the patient feel better, even for a few minutes, is frequently helpful. The patients who are continuously feeling miserable are very difficult to cure. Is it possible, therefore, that the exhibition of an animal extract, such as that of the testes or ovaries, may be the means of starting the curative process in action? I may say that I have never used testicular extract, but I have exhibited ovarian extracts in the treatment of the vasomotor disturbances of the climacteric with, I think, some success.

THE MEDICINAL USE OF ANIMAL EXTRACTS BASED UPON THEIR PHARMACOLOGIC ACTION

Reference has already been made concerning the use of animal extracts in relieving hypofunction of glands of internal secretion. In this connection the use of the drugs will be considered in a wider sense,—i.e., based upon their pharmacologic action. Unfortunately, there are only three drugs, namely, adrenalin, pituitrin, and thyroid extract, the physiologic actions of which have been studied. My remarks in this connection will therefore be limited to these three remedies.

Adrenalin.—This is the active principle of the medullary portion of the suprarenal gland. A common drug in use is a solution of active principle (1 to 1000). Other names of the active principle are epinephrin, suprarenin, and paranephrin. Epinin is an artificial product very similar to adrenalin. Adrenalin is a stimulant of the ends of the sympathetic (not the autonomic). Therefore its exhibition will increase the normal action of that division of the nervous system, acting on all parts of its distribution, including the thoracic and abdominal viscera and the blood-vessels. If the sympathetic is a motor nerve, the administration of adrenalin will increase the action. On the other hand, if the sympathetic is inhibitory, the exhibition of the drug will increase the inhibition. These are the principles which guide us in the use of adrenalin in the treatment of disease.

The principal diseases and morbid conditions in which the internal administration of adrenalin has been found useful in treatment are asthma, gastric hemorrhage, pain of gastric and intestinal diseases, and circulatory failure. I shall discuss briefly the use of the drug in the treatment of these affections.

Asthma.—This is characterized by spasm of the bronchi and bronchioles. In the treatment of the spasm it is important to keep in mind the nervous supply of the bronchi, as well as the different ways in which the spasm may be produced. The vagus supplies both motor and afferent filaments. The sympathetic is inhibitory. The spasm is generally believed to be the result of reflex action through irritation of the bronchi, mucous membrane of the nose, stomach, and other parts of the body, the motor nerve in the reflexes being the vagus. The function of the sympathetic is to check undue spasm produced by these reflexes. If the action of the sympathetic is ineffective, then asthma results. The use of adrenalin in asthma is for the purpose of increasing the inhibitory action of the sympathetic. The dose is ten to fifteen minims of adrenalin solution (1 to 1000) administered hypodermically. Some clinicians extol the use of adrenalin in the treatment of this disease. My experience is limited to about fifteen cases. In most of these the exhibition of the drug gave a great deal of relief from the dyspnoea; in one there was no apparent improvement. In one case a paroxysm was checked by fifteen minims of adrenalin, combined with one seventy-fifth grain of atropin sulphate. In the exhibition of these two drugs an attempt was made to diminish spasm in two ways, namely, (1) by stimulating the sympathetic, which is an inhibitory nerve, and (2) by depressing the motor filaments of the vagus by means of atropin.

The use of adrenalin in the treatment of asthma may be criticised from the fact that the period of its activity is short. It is well to remember, however, that there is frequently a good deal of psychic disturbance in asthma, and relief for a short time may, in itself, be helpful.

Gastric Hemorrhage.—The exhibition of adrenalin solution *per os*, twenty to thirty minims, in half an ounce of water, every half hour for five or six doses, is, I think, a rational measure in the treatment of this affection, for a hæmostatic action may be obtained without any perceptible rise of blood-pressure. It is obvious that the best time to begin the exhibition of the drug is immediately after the patient has vomited blood, for then there may be a little dilution of the adrenalin solution, and obviously more effective action. The reason why adrenalin, exhibited *per os*, does not produce a rise in blood-pressure is no doubt due to most of it passing into the intestine

and being decomposed in the alkaline juices of the intestinal canal.

Pain of Gastro-intestinal Disease.—From an etiologic standpoint, two kinds of pain, in diseases of the stomach and intestine, are recognized. One kind is caused by spasm of the musculature; the other by traction on adhesions between the viscera and parietal peritoneum. It is in the treatment of the first kind of pain that adrenalin is useful. As in the bronchi, the sympathetic is the inhibitory nerve, except possibly in the sphincters, and therefore the stimulation by adrenalin should tend to reduce the spasm. As in the treatment of asthma, the addition of one one-hundredth grain of atropin sulphate would probably augment the antispasmodic action of the drug, for in this viscus the vagus is the motor nerve, and the exhibition of atropin tends to paralyze the ends of its filaments. In a number of cases in my service in the Toronto General Hospital, by means of the fluoroscope or, where possible, by ordinary observation, the action and the effect of the administration of adrenalin hypodermically upon the peristalsis of the stomach have been watched. The results were very variable. In one case of pyloric obstruction with active peristalsis the administration of adrenalin abolished every sign of movement in the viscus. In another case of the same disease it produced no apparent effect. In cases of gastric ulcer with patent pylorus the action was variable. The drug was administered hypodermically in ten- to fifteen-minim doses. We have also given adrenalin for the relief of the pain of gastric ulcer with results which have been, as a rule, only partially successful.

Circulatory Failure.—In the treatment of circulatory failure one would think, from the study of the physiology of the circulatory system, that adrenalin would prove an ideal drug. We know that the medulla of the suprarenal gland is part of the sympathetic which supplies the motor nerves of the blood-vessels. We also believe that the suprarenals, by means of their hormone—adrenalin—take an important part in the maintenance of the normal blood-pressure. If the blood-pressure falls, it is possible for the suprarenals, by increasing the outflow of adrenalin, to raise it again, for the greater the quantity of adrenalin in the blood the higher the blood-pressure. From the consideration of these data it would seem that the administration of adrenalin would be an effective method of treatment of circulatory failure with low blood-pressure. In practice, however,

its use for this purpose has been disappointing to a great extent. The principal reasons for this are briefly as follows:

1. Adrenalin exhibited *per os* has practically no effect on blood-pressure, owing, no doubt, to the decomposition of most of the drug by the alkaline juices of the intestines.

2. Adrenalin administered intravenously produces a sudden rise of blood-pressure, which, however, lasts only for two or three minutes. The rise is so abrupt and the increase so great that the exhibition in this way is, I think, not free from danger. Some time ago, in a case in which I administered three minims of adrenalin solution (1 to 1000), diluted with 10 Cc. of normal saline solution, intravenously, the blood-pressure rose from 150 mm. to 195 mm. mercury in a few seconds. The patient complained of severe pain, first in the head and then in the back. All the symptoms disappeared and the blood-pressure dropped to 125 mm. in three or four minutes. It is obvious that the patient was not free from danger in this experiment, and one can readily understand how the exhibition of adrenalin intravenously may cause trouble, especially in elderly patients or in persons with arterial degeneration. In emergency cases, such as the treatment of shock, and poisoning by chloral hydrate or chloroform, the administration of a minute quantity, say one drop, diluted with normal saline, every fifteen minutes, might prove helpful.

3. The administration of adrenalin hypodermically frequently produces pain at the seat of injection, and with a moderate dose there is very little rise of blood-pressure, which does not last more than one or two hours. In this connection I should like to append a report of a long series of careful observations on the action of adrenalin on the blood-pressure and pulse made by Dr. H. M. East, Toronto.

EFFECT OF EPINEPHRIN AND EPININ ON THE BLOOD-PRESSURE AND PULSE

The following are the results of the administration of epinephrin and epinin. They were given hypodermically, preceded always by a hypodermic of sterile water, and any physical effect, if present, noted. The patients on whom the observations were made had some normal and abnormal conditions of the circulation. They were selected at random from public ward patients. The epinephrin used was the preparation known as adrenalin, which is a solution of one

part of active principle in 1000 of water. It was given in doses of ten minims and fifteen minims (0.6 mgm. to 1.00 mgm. of epinephrin). Such doses are said by Halsey to have a distinct effect upon the pulse and blood-pressure. Each of eighteen cases received ten minims in a half drachm of sterile water. In these eighteen cases there was an average rise in the blood-pressure of 4 mm. Hg, with an average lowering of the diastolic pulse of 8 mm. Hg, and an average increase of seven beats in the pulse-rate. In four of these eighteen cases there was no rise in the systolic pressure; in four there was no lowering; in one-half the number there was no increase in the pulse-rate. The maximal rise in the systolic and the maximal decrease in the diastolic occurred at about the same time, and about fifteen to twenty minutes after the dose was given. The normal was attained from one to two hours after. The effect of the ten minims of adrenalin (1 to 1000) could not be said to be well marked on either the pulse-rate or the blood-pressure. In eight of these same cases a dose of fifteen minims of adrenalin solution, or 1.00 mgm. of active principle, was given. These eight cases gave an average rise in the systolic pressure of 16 mm. Hg. There was an increase in the pulse-rate of an average of ten beats. The maximal increase and decrease in the pressure came quicker with the increased dose, viz., from three to fifteen minutes after the dose was given, and was normal in as short a time as with the smaller dose. The maximal rise in the systolic pressure remained at its height only for a minute or so, then fell at once to nearly normal. The decrease in the diastolic was generally more pronounced than the increase in the systolic, with less changes in its rise and fall. One case gave a rise in the systolic pressure from 120 mm. Hg to 200 mm. Hg fifteen minutes after the dose was given. During this increase in the systolic pressure the pulse fell from seventy to fifty beats to the minute, showing that the effect of central vagus stimulation, in that it slowed the heart, was greater than the direct action of epinephrin on the heart in accelerating it. Directly after the pressure fell from 200 mm. Hg the pulse rose from fifty to eighty beats to the minute. In this case the patient noticed distress for a short time.

Thirteen cases received epinin in doses of 1 Cc., injected subcutaneously by hypodermic. In these there was an average rise in the systolic pressure of 30 mm. Hg, with an average rise in the

diastolic of 12 mm. Hg. The increase in the pulse-rate was very uncertain, seven of the thirteen cases showing no increase at all. The length of the time for the pressure to reach its maximum was from five to twenty minutes after the dose was given. The marked difference between this drug and epinephrin is the fact of the raising of the diastolic blood-pressure in the former and the almost constant lowering of it in the latter.

Pituitrin.—This extract is made from the infundibular portion of the pituitary gland. We have already briefly referred to pituitary extracts in the treatment of diseases of the hypophysis, and called attention to their ineffectiveness in the treatment of those conditions. But there are many other affections in which pituitrin is of value in treatment.

In making use of pituitrin in the treatment of disease the pharmacologic action of the drug should be our guide. Pituitrin stimulates smooth muscle in all parts of the body, which action is quite independent of the innervation of the part. This is in marked contrast to the action of adrenalin, which causes contraction of smooth muscle through stimulation of the ends of the sympathetic. The results of the action of adrenalin vary with the function of the sympathetic. If the nerve is motor, the exhibition of the drug will cause contraction of smooth muscle. On the other hand, if the sympathetic is inhibitory, as it is in the body of the stomach and intestine, then the exhibition of adrenalin will reduce the tonus. If pituitrin is administered, however, smooth muscles of all organs contract.

The action on the heart has not been definitely determined. According to Dale, the action is slight, but similar in kind to that of digitalis.

The usual dose of pituitrin is 1 Cc. (fifteen minims). The drug is generally exhibited hypodermically or intramuscularly. The period of its activity varies, as a rule, from one to three hours. The hypodermic administration does not, as a rule, cause but little discomfort.

The medical diseases and morbid conditions in which pituitrin is specially useful in treatment are acute dilatation of the stomach, meteorism with constipation, and circulatory failure.

Acute Dilatation of the Stomach.—This may be due to a variety of causes, including shock following traumatism, errors in diet, in-

fectious diseases, and laparotomies. The genesis of the affection is not definitely known. Spasm of the pylorus has been named as a causative factor, as has also obstruction at the duodenojejunal juncture.

The commonest variety is probably that form seen after surgical operations, and especially after laparotomies. In this type there are probably two varieties, one dynamic, the other destructive.

In the treatment of acute gastric dilatation, and especially in the dynamic type of the disease, it is well, after thorough lavage, to administer a drug such as pituitrin or eserine to increase the gastric tonus. The dose should be repeated every two or three hours for three or four doses. As the object of this statement is merely to call attention to indications for the use of pituitrin, I shall not discuss further the treatment of acute dilatation of the stomach.

Constipation with Meteorism.—In acute diseases, and especially in pneumonia, the physician is frequently called upon to give quick relief from meteorism. As an adjuvant to a cathartic or purgative enema there is nothing equal to a dose of pituitrin. In our service we have frequently made use of pituitrin for this purpose during the last few months with, as a rule, great advantage. For obvious reasons I should not advise the use of pituitrin in the treatment of meteorism occurring in the course of typhoid fever.

Circulatory Failure.—In the treatment of circulatory failure with low blood-pressure, such as one has frequently to contend with in pneumonia, shock, and other affections, pituitrin is a very valuable drug. It has the advantage over adrenalin given hypodermically in that, first, it invariably raises the blood-pressure, and, secondly, it keeps the blood-pressure raised for a considerable time; whereas the effect of adrenalin is not constant, and, when it is present, is more transient. If the statement of Dale should be confirmed concerning the action of pituitrin on the heart, the drug should have a very wide application in the treatment of acute disease. I think, however, until there is further evidence, one should be content with the exhibition of two or three doses a day.

Thyroid Extract.—Reference has already been made to the use of thyroid in the treatment of myxædema and cretinism, conditions which are characterized by hypofunction of the thyroid gland. But these are not the only affections in which this is of value in treat-

ment. In simple goitre, especially in the form which occurs in girls at puberty or early adolescence, it is very valuable. In explaining the action of the drug in simple goitre one must take for granted—which I think is generally accepted—that the percentage of iodine in iodothyryn—the active principle of the thyroid—is variable, and that the more iodine present the greater the physiologic activity of the gland. If the thyroid is poor in iodine, then hypertrophy of the glandular tissues ensues, in order to render the secretion functionally efficient. A patient, therefore, with simple goitre has an excessive quantity of low-grade active principle. If one administers an extract of the thyroid of the sheep to such a patient, then the grade of the active principle is raised, and the hyperplasia of the glandular tissues undergoes atrophy, and the goitre diminishes in size. Preparations of iodine other than thyroid are probably equally effective.

In studying hyperthyroidism, hypothyroidism, and simple goitrous conditions, in which the active principle of the thyroid has an etiologic relationship, one gains some insight into some of the physiologic actions of thyroid extract which gives us some idea of how to make use of the drug in the treatment of disease. A full discussion of this subject would lead beyond the limits of this paper. I shall therefore be content to mention a few of the more important physiologic activities and give a brief summary of the medicinal applications induced from them.

1. Hyperthyroidism of Graves's disease, as well as that produced by the exhibition of thyroid extract, is generally characterized by emaciation. This emaciation is probably due to a variety of causes, of which increased metabolism is the most important. The increased chemical activity chiefly affects the metabolism of fats. The inference to be drawn from this is that thyroid extract is useful in the treatment of obesity. Clinical experience, I think, supports this view. According to my experience, the loss of weight is most marked in fat patients suffering from simple goitre. Care should be exercised in the administration, as it is possible that Graves's disease and diabetes may be precipitated. The maximum daily dose of thyroid extract should not, I think, exceed twenty grains.

2. Patients suffering from myxœdema are very susceptible to infection, and it is stated that the exhibition of thyroid extract raises

the opsonic index and the phagocytic properties of the leucocytes. These observations suggest the use of thyroid extract in chronic infectious diseases. This has led some clinicians to make use of the drug in the treatment of rheumatoid arthritis. From the literature one is unable to draw any definite conclusions as to the value in this affection. I have frequently exhibited thyroid extract in the treatment of acne vulgaris. It will be remembered that acne and simple goitre are prone to occur at puberty. Is it possible, therefore, that there is a relationship between them as regards etiology? This suggested to me that such is possible and led me to make use of it in the treatment of acne. In some cases it has, I think, undoubted favorable influence.

3. Other medical diseases in which thyroid extract has been used are infantilism and tetany. It is possible to present a certain amount of evidence in favor of these treatments. Its use in infantilism was probably suggested from the fact that the cretinism might very well be looked upon as a type of infantilism, and thyroid extract is an effective remedy in its treatment. Clinical evidence gives support to a certain extent to this view. A form of tetany is, we know, caused by excision of the parathyroids. Now it is held by some that the thyroid and parathyroid are closely related in function, and it is thought that possibly the exhibition of thyroid would for this reason tend to correct the disturbance of tetany. Clinical experience gives very little support to this view.

CHRONIC HABITUAL CONSTIPATION: A PRACTICAL CONSIDERATION OF ITS CAUSES, RESULTS, AND ITS RATIONAL TREATMENT BY MECHANICAL MEASURES ¹

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THERE can be no question that the simple neglect of the "*calls of Nature*" to observe the regularity in the hour of defecation or to devote sufficient time to the act are the most important factors in numbing the impulses essential to bowel regularity. Habitually to disregard or defer the normal impulse of defecation eventually disorganizes the mechanism of defecation, which sooner or later interferes with the normal sequence of processes in the gastro-intestinal tract. The important influence of this function can only be appreciated when the equilibrium is disturbed, which ultimately spells disaster, though years may elapse before that occurs, because the body is unable to wrestle physiologically with the toxins elaborated when the human sewerage system is clogged up. This indirectly brings in its train one of the ills that may be traced to the absorption of the products of intestinal decomposition. The nature of the disease brought on depends on the particular path of least resistance that is offered to the malefic force expressed by the invader.

Daily evacuations, under normal conditions, result from the contents of the alimentary canal being propelled by colonic peristaltic contractions, which collect in the pelvic colon, at an acute angle formed by the pelvirectal flexure, where they rest until ready to pass out through the rectum and anal canal as a fecal movement. The gradual accumulation of the fæces in the pelvic colon during the previous twenty-four hours causes the distended pelvic colon to rise and obliterate the acute angle it forms with the rectum so as to facilitate the passage of the fæces into the rectum, resulting from the active peristaltic contractions of the colon,² generally brought about reflexly

¹ Read before the Philadelphia Clinical Society.

² The normal peristaltic contractions of the colon do not reach the rectum except during defecation, otherwise the rectum is at rest and empty.

by such stimuli as the entrance of food into an empty stomach at breakfast, drinking a glass of cold water on arising, a cold bath, or the muscular activity involved every morning in getting up and dressing, these being powerful stimuli to intestinal activity. When the natural stimuli fail to force the fæces into the rectum, the desired result may be produced by voluntary contractions of the abdominal muscles and diaphragm, thereby increasing the intra-abdominal pressure.

The actual desire to defecate is produced when the rectum becomes distended as a result of the pressure exerted by the entrance of fæces, which causes peristaltic contractions by stimulating the nerve-ends in the mucous membrane, giving rise to the peculiar sensation³ of the desire to defecate, together with an uncomfortable sensation of weight in the perineum and at the same time reflexly stimulating the external sphincter⁴ to contract, so as to close the anal canal, which temporarily delays the act of defecation till the rectum is full. Then the act of defecation is set in motion and completed reflexly by the peristaltic contractions initiated by the rectal stimuli, which send afferent nerve impulses to a centre in the lumbar spinal cord,⁵ where they set in action efferent nerve impulses, producing contractions of the muscular wall of the rectum, which is facilitated in its action by simultaneous voluntary contraction of the abdominal muscles, diaphragm, and voluntary relaxation of the external sphincter, resulting in the expulsion of the contents of the rectum. Usually reflex peristaltic contractions of the colon cause it to empty itself at the same time.

If after the fæces have entered the rectum⁶ the desire to defecate

³The sensation of the desire to defecate may be artificially produced by inflating the rectum. The desire is never present when the entire rectum has been removed by surgical procedure.

⁴The external sphincter, being a voluntary muscle, is under the control of the will, and may have its action augmented or inhibited by impulses arising in the brain and acting through a centre situated in the gray matter of the conus terminalis, which is therefore the centre for the reflex action of the sphincter when the anus is irritated.

⁵The exact nature of the nervous mechanism of defecation is not yet fully understood.

⁶The fæces remain in the rectum and do not go back into the colon by antiperistalsis, as was once thought. This can be demonstrated by the X-ray and digital examination.

be unheeded, it will pass away after a period of rest. This disappearance of the desire is due to the relaxation of the contracted rectal muscular wall, which naturally becomes fatigued after a period of distention, as the strong expulsive efforts, when retarded by a voluntary contracted sphincter, soon weaken in a majority of people. The desire is again experienced once or twice during the day on account of the entrance of more fæces into the rectum, accompanied usually with a little colicky pain. Should the desire be continually neglected, the nerve-ends become blunted by prolonged contact with the fæces. Every time the desire is not satisfied the mucous membrane becomes less sensitive, until finally the rectum is trained to disregard the irritation produced by the presence of the fæces. Ultimately a full rectum will not create the slightest desire to defecate; the centres in the cord gradually lose their sensitiveness to normal response. If the condition is fairly well advanced there will be necessary a greater voluntary effort to initiate the defecation reflex, which may result only in a partial evacuation when the rectum is overdistended with fæces.

Eventually the persistent failure to defecate leads to the gradual accumulation of the fæces in the rectum and pelvic colon, which gradually become more and more distended, frequently to an unbelievable extent. The persistent failure to defecate or an incomplete evacuation after a great voluntary effort impairs their secretory activity and muscular tone and finally produces in them atony and dilatation (Fig. 1); they become incompetent to do their work. In extreme cases, if the habit is persisted in, the rectum and pelvic colon may become parietic. As a result of the abnormal delay of the passage of the fæces through the intestines, atony and dilatation may extend throughout the entire length of the colon (Fig. 2), though it may take years to accomplish it. In extreme cases the abnormal delay causes the weighted transverse colon to loop down in the lower part of the abdomen, frequently causing the bowel to angulate or kink at its point of support and increasing the disorganization of defecation. Owing to the close physiological connection between the different parts of the alimentary canal a vicious circle is inaugurated by the disturbance, causing a depression all along the line.

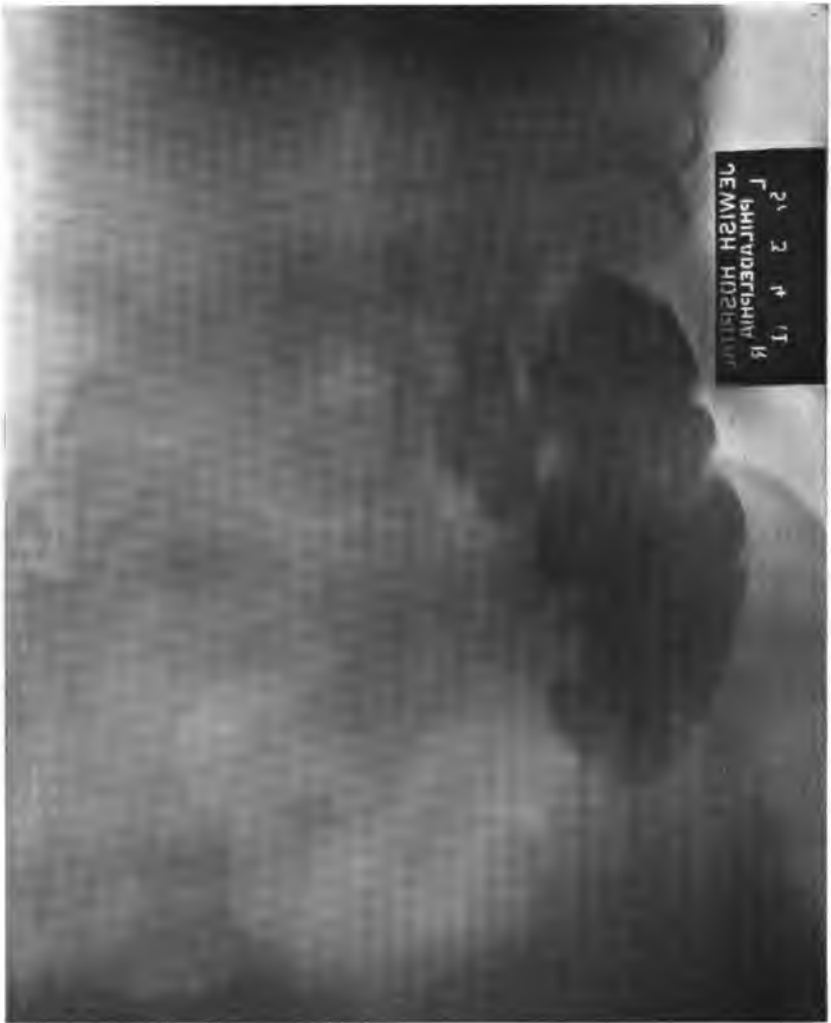
The same form of constipation may be produced in a slightly different manner, but the effect is virtually the same, because the

FIG. 1.



Röntgenogram showing a greatly dilated rectum as a result of chronic habitual constipation.

FIG. 2.



Röntgenogram showing the entire colon greatly dilated with prolapse of the transverse colon in a case of chronic habitual constipation of long standing.

Б. В. В.

secretory activity and muscular tone of the rectum and pelvic colon are impaired by interfering with their normal nerve and blood supply.⁷ The impairment of the nerve and blood supply arises from continuous pressure upon the buttocks produced by assuming a cramped or faulty position at a desk or bench (Fig. 3) for a number of hours. Such position, by hindering the full expansion of the chest, prevents the upward and downward excursions of the diaphragm and causes the abdominal muscles to relax and become weak. A more or less fecal stasis results from the sluggish peristaltic movement in the bowel. The fecal masses gradually become harder, drier, and more difficult to move, so that ultimately these dry, hard masses give rise to considerable trouble by accumulating in the rectum and pelvic colon; it therefore is impossible to produce the requisite rise in intra-abdominal pressure so as to empty properly the atonic and dilated rectum and pelvic colon, thus producing inefficient defecation. This condition is most frequently observed in teachers, bookkeepers, school children, stenographers, watchmakers, and shoemakers, whose vocations compel them to lead a sedentary life and to assume for a number of hours daily a faulty or cramped position.

Habitual constipation is prone to develop in women, especially in those of the upper walks of life, as they will defer going to the toilet on the slightest pretext. They prefer to delay the desire if the toilet is somewhat inaccessible. Women in easy circumstances, inclined to obesity, having a distaste for outdoor exercises, who shop by phone and go automobiling for recreation, aggravate the condition because the beneficial effects derived from walking are lost. No doubt many of the younger women in these classes take active exercises, but as they grow older they fall into sedentary habits. Young girls entertaining friends or on a social call are often prompted by false modesty to delay the desire rather than suffer the embarrassment of being seen going in the direction of the toilet. They fear it may give rise to the unsavory idea of defecation, particularly if the toilet is somewhat publicly located. In factory and shop girls many cases develop from the suppression of the alimentary toilet. They prefer the discomfort and danger of postponing the act till

⁷ It has been demonstrated by a series of experiments that the circulation throughout the intestines greatly influences the peristalsis, and that any disorder in the blood supply readily brings about an intestinal disorder.

they arrive home rather than use a closet that is offensive, cold, uncomfortable, or inaccessible.

Constipation, as a rule, affects men less frequently than women. It occurs mostly in the busy merchant or professional man, especially in those living in the suburbs. The necessity of catching the train often compels them to hurry their breakfast and defer defecation. During business hours they are so occupied that the alimentary hygiene is continually neglected, thereby inducing a chronic form of "habit constipation." The same condition is frequently met with in modest and timid school children, because they dislike to ask to go out during school hours, for fear of annoying the teacher. Often the closets are so offensive as to increase the natural objection which children, especially the girls, feel to the act.

Many develop the habit by unduly delaying the normal impulse of evacuation when the act is painful, as is frequently observed in those suffering from local diseases of the rectum, anus, or adjacent organs. This occurs in hemorrhoids, fissure in ano, excoriations of anus, benign tumors and polyps of the rectum, abscess or inflammation of the prostate, prolapsed ovary and retroverted uterus, etc. Often in these patients the pressure of hard feces makes the act more painful or frequently causes a reflex spasm of the external sphincter, rendering the act of defecation impossible for the time being. Often in these cases the constant irritation of the external sphincter causes it to undergo hypertrophy and become tetanically contracted,⁸ so that a great voluntary effort is required to force the feces through it. This often results in the culminative form of chronic habitual constipation, in which insufficient amounts of feces are excreted, although the bowels may be opened every day.

The modern tendency of using highly-prepared food in order to get the maximum amount of nourishment with the minimum amount of cooking or mastication constitutes a national danger. Such diet may cause or aggravate any form of constipation, since the bulky residue originating from a proper proportion of innutritious food will be lacking. Other dietetic errors, such as irregularity or undue haste in meals, eating excessive quantities or unwholesome foods, and the insufficient ingestion of water, aggravate this form of constipation.

⁸ Hertz, A. J.: "Constipation and Allied Intestinal Disorders," Oxford Medical Publications, London, 1909, p. 147.

FIG. 3.

A



B



Photographs (A) showing faulty position of stenographer due to habit; (B) proper position with individual sitting upright, thus preventing interference with respiration and relaxation of abdominal muscles, and distributing weight to thighs instead of leaving it entirely on the buttocks.

1900

SYMPTOMS

The symptoms of chronic habitual constipation are chiefly produced either by intestinal auto-intoxication or mechanical pressure on the surrounding structures, while others are purely reflex in origin. After the condition has existed for some time, and increasing purgative doses fail to produce a satisfactory result, the majority of patients seek medical advice. Frequently they complain of one of its associated symptoms, often attributing the phenomena to derangements of the stomach and liver. These phenomena are characterized by a furred tongue, disagreeable taste in the mouth, and loss of appetite, with consequent loss of weight. Not infrequently they complain of sensations of pressure and distention in the abdomen, especially discomfort along the course of the transverse colon, often in the form of heart-burn, with regurgitation of bitter fluids, nausea, occasional vomiting, and flatulence. In well-advanced cases symptoms referable to the gastro-intestinal tract and liver predominate, especially if this condition is complicated by visceroptosis or intestinal stasis, or if the muscular tone and secretory activity have been depressed or altered for a long time. Eventually there appear fermentative and putrefactive changes, which give rise to the well-known symptoms of auto-intoxication, such as headache, vertigo, depression in spirits, disinclination to work, and at times a form of neurasthenia, with very depressing symptoms. Occasionally these patients seek relief from the paroxysmal neuralgic pains caused by mechanical pressure; these pains may be referred to the coccyx or suprapubic region, and frequently disappear after the bowel is emptied.

When consulted for the relief of chronic habitual constipation or one of its associated symptoms, or one of the more obscure diseases originating from it, such as acne vulgaris, anæmia, or asthma, the importance of eliciting a careful history in reference to the patient's diet and alimentary habits will be seen when the question of treatment presents itself. It may be possible to deduce that the condition the patient complains of, though very remote at times, originates from the impeded fecal movements. Then we can intelligently treat the condition by removing the underlying causes. The patient is carefully examined and the abdomen palpated for evidence of any condition that may cause or aggravate the constipation. A bimanual

examination should be made in every female, and a careful examination of the genito-urinary organs in every male, because reflex irritations from these organs may cause or aggravate the condition. The rectum and pelvic colon must be examined in every case by carefully exploring them with a proctoscope, the patient being in the knee-chest position.

It is important to bear in mind that constipation is only a relative condition. It is best defined as a condition in which none of the residue of a meal taken eight hours after defecation is excreted within forty hours.⁹ In doubtful cases, where constipation is thought to exist or be the underlying cause of some remote condition, it may be ascertained by giving the patient two teaspoonfuls of charcoal with a meal eight hours after defecation,¹⁰ and if no black stools are observed within forty hours constipation is present. This constipation may be due to faulty mechanical action of the rectum or to intestinal stasis. These conditions can only be separated with absolute certainty by the X-rays. After the large intestines on the previous day and on the morning of the first examination are completely emptied by an enema the patient is given for breakfast two drachms of bismuth oxychloride suspended in milk. A series of röntgenograms or röntgenoscopic examinations are made at frequent intervals during the next two or three days. During the period of observation the patient is directed to continue the usual mixed diet, and, if possible, to carry on the ordinary occupation. Whether the constipation is due to intestinal stasis or faulty mechanical action of the rectum is determined by the presence of kinks, angulations, or any other condition that may cause it, or by shadows of a dilated rectum, or perhaps by both conditions.

TREATMENT

In treating chronic habitual constipation, not as a mere symptom but as a distinct affection by itself, it at once becomes evident that it may be the logical result of a wide variety of causes, some being initial active causes, while others—without rising to the dignity of active causes—may still be contributory factors, which by their

⁹ Hertz, A. J.: "Constipation and Allied Intestinal Disorders," Oxford Medical Publications, London, 1909, p. 46.

¹⁰ The charcoal may be given immediately after the bowels have been emptied by a high compound enema.

presence increase its severity and thereby the difficulty of its correction. Therefore in laying out a comprehensive scheme of treating this form of constipation, in the light of our latest discoveries and researches, a clear conception of the pathologic conditions present in every individual case is imperative, especially when trying to imitate successfully the normal physiologic methods, which are so efficient in health, till the normal equilibrium can be maintained. Frequently it taxes our utmost skill and patience to select properly and combine those methods that will successfully increase the efficiency of the natural forces of elimination in a dilated and atonic rectum and pelvic colon where the physiologic secretions and functions were exhausted by overwork or perhaps aggravated by some other condition. It is absolutely essential, therefore, to correct, first, any previously-mentioned local condition that may cause or aggravate the constipation, by its presence preventing natural movements. These conditions are generally amenable to proper treatment, which rarely fails to overcome them. Abdominal conditions, such as congenital weak abdominal muscles, weakness of the intestinal musculature, intestinal stasis, and visceroptosis, can be corrected, at least to a satisfactory degree, by applying the proper mechanical or supportive measures, which will greatly aid us in gaining our desired results.

It has been conclusively demonstrated that the continual neglect of the alimentary hygiene is the most important factor in causing chronic habitual constipation; it is the most frequent cause of constipation in a majority of every variety of cases. It is obviously imperative that, before any results can be obtained, the faulty habits must be immediately corrected, not only by instructing the patients to correct their alimentary hygiene, but also by impressing them with its importance to attain the desired result; this is an indispensable part of our method of treating this condition and every other form of constipation. The patients should be instructed to select a definite time each day to go to the toilet (preferably in the morning, right after breakfast). The toilet selected should be one that is comfortable and easily accessible, so they can devote to the act with comfort at least fifteen minutes. The patients must be instructed to wait a few minutes after the last stool has passed so as to be sure there is no more fecal material left in the rectum, thereby preventing any further decrease in the sensibility of the rectal mucous membrane.

The act is facilitated by having the toilet seat at the proper height, so the patient can assume a squatting posture, thereby increasing the mechanical aid to defecation, produced by flexing the thighs on the abdomen. It is of the utmost importance to impress upon them the necessity of going to the toilet at a definite time each day, whether the desire is present or not, so as to gradually retrain the reflex centres in the cord to respond to the normal stimuli of defecation. Often the faulty habit exists so long that some people unconsciously get a fixed idea that their bowels cannot move unless some artificial measure is taken daily to secure a regular action of the bowel. They fear that a dangerous condition will result if the customary pill or enema is omitted. In such cases an attempt should be made to persuade the patient to believe that the constipation is merely the result of a faulty habit, which can readily be completely overcome without recourse to artificial means if the simple measures of alimentary hygiene are observed, together with some slight changes in the diet.

The fact that dietary errors are the commonest of all the numerous causes that aggravate habit constipation makes it imperative that this should be corrected at once, since frequently complete relief can be obtained by merely correcting the diet and alimentary hygiene. In considering the relation of dietary errors to constipation unlimited space could be utilized, as the subject is practically inexhaustible; but the general conclusion has crystallized itself from the observations of those who studied the problem in its manifold aspects that the personal equation of the individual is, after all, the fact that determines in every instance the particular way in which the diet causes constipation. Frequently the best diet for each individual case can be determined only by oft-repeated trials and observations. The idea is to put the patient on a natural laxative diet, consisting not only of foods having all the elements necessary to nourish amply the body, but also of a large proportion of indigestible material in the form of cellulose, that will result in the formation of a soft, bulky mass of fæces, so that the residue is sufficient to be acted upon by the intestines, to promote its own peristalsis, in order that its passage through the intestines should not be delayed and reach the rectum in a comparatively soft condition, so that little force is required to expel it. Care must be taken, in the early stage of the treatment,

not to get a too bulky or coarse indigestible residue, that will excessively irritate the overdistended and atonic rectum and pelvic colon, because the hard particles of undigested vegetable matter present in the fæces remain in contact with the mucous membrane for a considerable time and may give rise to a catarrh.

It is evident that intelligent coöperation of the patients is essential, because they must carefully follow the instructions given them, especially in reference to the time and quantity of the food. Special emphasis must be laid on the value of eating slowly and properly masticating the food.

The subject is so vast that in summarizing the various dietetic measures only the broadest generalizations can here be given. These dietetic measures, so often neglected, have a definite place in the management of constipation. Their importance warrants their enumeration:

1. It is probable that many constipated persons drink too little water; it may be necessary to encourage them to drink at least eight glasses a day, the first glass on arising and the last on retiring. They should drink little at meals and plenty between meals.

2. They should be encouraged to drink freely the beverages of fruit juices, buttermilk, and sour milk; these are intestinal correctives and laxatives. There should be included in their diet plenty of plain soups and broths.

3. They should be instructed to eat sufficient amounts of raw or stewed fruits, which produce beneficial laxative effects by increasing the peristalsis. It is best to have the patient eat at each meal one fruit, preferably with skin and seeds, and, if possible, a large apple or orange before retiring.

4. The special diet to be used by persons with a tendency to constipation should include coarse bread, porridge, and sufficient vegetables. Such a diet, and especially green garden truck (chiefly cellulose) with each meal, would assure a large, bulky residue. When these articles of food cause indigestion their use must not be persisted in. We must substitute well-cooked green vegetables or stewed fruits, which can be obtained at all times of the year.

5. The moderate use of fats and oils, such as butter and olive oil, is to be recommended, because they are highly nutritious and help to lubricate the intestinal tract.

Constipated persons should be instructed to avoid the food which has a constipating effect. The following, in most cases, are to be avoided: Richly-made dishes, such as creamed soups and most chafing-dish products; also salted, potted, preserved, or smoked meats and fishes, fresh pork, duck, dark meat of fowls, liver, brains, sweet-breads, gravies, spices, baked beans, rice, tapioca, macaroni, spaghetti, rich stews, blackberries, and excess of sugar, candy, pastry, nuts, cheese, crackers, white bread, biscuits, griddle cakes, soda water fountain drinks, malted milk, ginger ale, spirits, especially brandy and red wines, heavy beers, ales, and cordials. The patients should also be instructed not to drink milk or tea with their meals. China tea may with advantage replace the more astringent varieties from India and Ceylon.

That the correction of any or all these conditions will procure permanent relief in every case can hardly be expected. The constipation may have existed so long that the entrance of fæces into the dilated and atonic rectum may not give rise to any desire to defecate; it may give rise to such weak peristaltic contractions which only partly empty the rectum, even though a great voluntary effort is made. This occurs particularly when the weak peristaltic contractions cannot wholly overcome the resistance offered by a normal or tetanically contracted and hypertrophied sphincter. The result is a culminative form of chronic habitual constipation, because part of the fæces remains in the rectum, although the bowels move every day.

Heretofore the treatment of chronic habitual constipation was limited and unsatisfactory, but recent investigation points to the desirability of treating this form of constipation by aiding and supplanting the natural processes by some mechanical form of treatment, rather than superseding them by artificial measures, in order to restore the secretory activity and muscular tone of the rectum and pelvic colon. To treat this condition the medical profession was offered many drugless methods of treatment, such as various kinds of hand, cannon-ball, electric, and vibratory forms of external massage and numerous forms of gymnastic exercises. All were given a thorough trial by the profession. While satisfactory results were obtained in certain cases, there still seems something to be desired as a successful routine method of treatment. More recently a series

of extensive clinical investigations demonstrated that mechanical stimulation of the mucous membrane by direct massage of the rectum and colon, with dilatation of the external sphincter by using such cumbersome methods as tamponing the rectum and colon with cotton or wool, inflating rubber bags in the rectum and colon, or by simply inflating the rectum and pelvic colon with air through a proctoscope while the patient is in the knee-chest position, all produced satisfactory evacuations. These investigations further demonstrated that any foreign body which stimulates the normal contents of the bowel will produce satisfactory peristaltic contractions, thus conclusively proving the purely mechanical part the *fæces* play in producing the stimuli to defecation. Eventually it was observed that this mode of treatment gradually restored the normal tone and secretory activity of the rectum and pelvic colon by producing a gentle stimulus to the muscular wall and by gradually dilating the external sphincter. This method gave results in chronic habitual constipation of a character and permanence possible from no other method of treatment, since it eventually results in a permanent cure by restoring the normal condition of the bowel.

Recently many authorities have reported permanent cures in individuals suffering from chronic habitual constipation. Their treatment consisted of pneumatic massage of the rectum and pelvic colon and systematic dilatation of the external sphincter, best accomplished by using the simple apparatus (Fig. 4) suggested by Hirschman,¹¹ consisting of a specially shaped rubber bag about five inches long, with a stem, which is slipped over the distal end of a canalled Wales bougie, having an air-vent in the handle, which is covered by the finger while the bag is inflated with air to conform with the size and shape of the rectum and sigmoid colon. My experience in a large number of these cases has convinced me that better results may be obtained in a shorter period of time by having the bag studded throughout with small pointed rubber elevations, so that the mucous membrane may be more efficiently stimulated. This is accomplished by simply tying on the end of the Wales bougie, under the rubber bag, a condom, having a number of granules (size and shape of buckshot) fastened on it, so that when the bag is inflated an irregular

¹¹ Hirschman, L. J.: "Hand-book on Diseases of the Rectum," C. V. Mosby Medical Book Publishing Company, St. Louis, 1909, p. 86.

surface (Fig. 5) will present itself to the mucous membrane of the bowel.

Hirschman's apparatus, or my modification of it, can be operated with a hand bulb or an electric tankless pump in giving the pneumatic massage to the rectum and pelvic colon and systematic dilatation of the external sphincter. If the hand bulb is employed the method of treatment is as follows: The patient is placed in the Sims position (Fig. 6) and the deflated bag is lubricated and twisted upon itself, then with a spiral manœuvre passed slowly into the rectum, following the curve of the sacrum, until it reaches the desired height in the pelvic colon. When the bag is in position it is inflated to conform to the size and shape of the rectum and pelvic colon by using an ordinary atomizer bulb until the patient complains of feeling a sense of fullness, crampy pain, or desire to move the bowels. Then the air is allowed to escape by removing the finger from the air-vent. The bag is alternately inflated and deflated at intervals of five to ten seconds. While inflated the bag is gently moved to and fro so as to stimulate the mucous membrane and massage the muscular coat, causing the mucous membrane to regain its secretory activity and the muscular fibres to contract and gradually regain their tone. In this way the natural forces of elimination are finally restored. Care should be taken not to inflate the bag too much, as it will overdilend the rectum and pelvic colon, aggravating the condition we are trying to remove. The method of withdrawing the apparatus is very important, since by this manœuvre the external sphincter is dilated. This dilatation is produced by slowly withdrawing the apparatus with a to-and-fro motion, having both holes in the handle covered by the thumb and finger-tip to keep the bag inflated.

When giving the pneumatic massage and dilatation with a tankless air-pump I use a specially-constructed rubber tube with an air-vent and two stems at one end (Figs. 7 and 7 B); to one is attached a hand bulb, and the other is connected with the electric air-pump. The treatment is given as follows: With the patient in the Sims position the bag is inserted to the desired height as already described, then the bag inflated with the hand bulb till the patient complains of a sense of fullness, crampy pain, or desire to defecate; the tankless pump is then started to give pneumatic massage (having previously regulated it to give the slowest and weakest alternating

FIG. 4.



Hirschman's pneumatic rubber dilating rectal massage bag, partly inflated, equipped with a hand bulb.

FIG. 5.



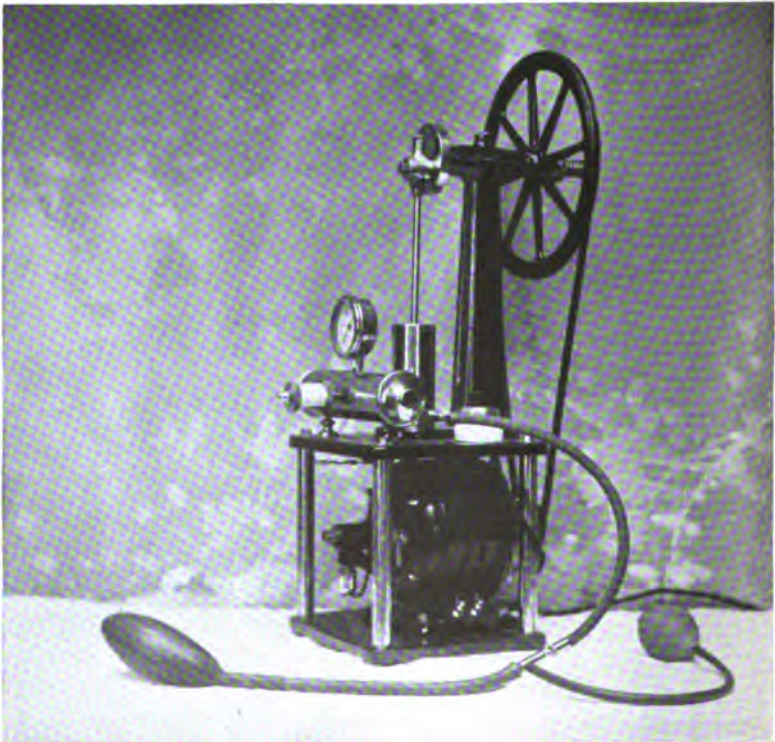
Modification of the Hirschman apparatus by the author.

FIG. 6.



Position of patient and operator for giving a treatment with the pneumatic rubber dilating rectal massage bag.

FIG. 7 B.

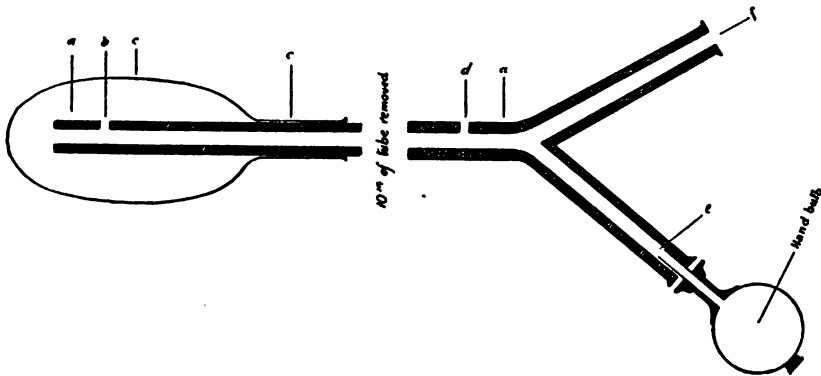


Photograph of author's apparatus for giving pneumatic massage and dilation, attached to an electric tankless air-pump.

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inflation and compression stroke). While the massage is being given the bag should be inflated and deflated alternately with the hand bulb, the air-vent being covered by the finger during inflation and open during deflation. The method of withdrawing the apparatus so as to dilate the sphincter is the same as previously mentioned, only here the dilatation of the external sphincter is more efficiently accomplished, because the machine is kept in motion when the inflated bag is slowly removed. This method has given splendid results in a large number of cases. The procedure appeals to me because of its simplicity and the ability of the operator to have absolute control over the amount of force exerted when giving the massage.

FIG. 7.



Schematic drawing of author's tube for giving pneumatic massage and dilatation with an electric tankless air-pump: *a*, rubber tube; *b*, air-vent; *c*, rubber bag; *d*, air-vent in handle; *e*, stem connected with hand bulb; *f*, stem connected with electric air-pump.

My experience in treating a large number of these cases by this method has convinced me that especially in cases of long standing the best results are obtained when the first three or four treatments are performed on an empty rectum,¹² so that the rectum will have the benefit of a whole night's rest and be in better condition to massage the following morning. The treatments last from five to fifteen minutes and should be given at a definite time each day, preferably in the morning after breakfast. Daily treatments are given for the first seven days, with instructions to the patient to try and defecate after each treatment. After the third or fourth treatment he will

¹² Have the patient to empty the rectum with a low soap or oil enema on the evening preceding the treatment.

have a small, unaided movement. After the first week treatments are given on alternate days, with instructions to go to the toilet at the stated time on the interval days; the patients will report a slightly larger stool and more satisfactory defecation. As the defecation approaches normal the intervals are gradually lengthened to two days, then to three days, and so on, until one treatment is given weekly, if the defecation continues satisfactorily. When the patient reports satisfactory daily evacuations for two or three weeks the patient is discharged as cured and asked to return for another treatment on the first day that a normal stool is absent.

As a routine treatment this method has given splendid results in the most obstinate cases of chronic habitual constipation of years' standing. These cases have been successfully treated and cured in one to three months' time, provided the case has been properly diagnosed and the patient faithfully coöperates by correcting the diet and alimentary habits when massaging the rectum and systematically dilating the external sphincter.

There is no doubt in my mind that the good results obtained by this method of treatment are in a large measure due to the systematic dilatation of the external sphincter, as we know that many cases of chronic habitual constipation have been cured merely by systematic dilatation of the external sphincter with graduated rubber bougies. In long-standing cases of chronic habitual constipation the external sphincter may become tetanically contracted and hypertrophied¹⁸ as a result of chronic spasm, especially when produced by continuous irritation of some local condition. It is obvious that in these protracted cases dilatation of the external sphincter with Hirschman's apparatus will not relieve the condition, as the resistance offered by the tetanically contracted and hypertrophied sphincter is too great to be overcome by the pressure produced with the pneumatic dilating bag; consequently the constipation will persist, in spite of the fact that the muscular tone of the rectum and pelvic colon has been restored by systematic massage. These cases are so rebellious to the ordinary methods of treatment that manual dilatation of the sphincter, under a general anæsthetic, is necessary before the condition is successfully relieved. Far beyond my expectations, I have found that

¹⁸Hertz, A. J.: "Constipation and Allied Intestinal Disorders," Oxford Medical Publications, London, 1909, p. 147.

FIG. 8 A.



Author's hydrostatic sphincter dilating bag (partly inflated).

FIG. 9.



Position of patient and operator for the author's method of dilating the external sphincter.

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relief from this annoying condition, which requires dilatation under a general anæsthetic, may be obtained by systematically overstretching the external sphincter to reduce its tonicity by means of a rubber hydrostatic dilating bag (Fig. 8 A), an inexpensive apparatus¹⁴ which I have devised, consisting of two pieces of Penrose drain about six inches long, with a silk bag¹⁵ inserted between them, which is tied to the closed end of a specially-constructed rubber tube having air-vents near the closed end.

The treatments with this apparatus are given in the following manner: After determining the full capacity of the bag, it is lubricated and introduced to its proper position in the anal canal, with the patient in the Sims position (Fig. 9), so that one-half of the bag is exposed, and hydrostatic pressure gradually made by means of a steel syringe (holding about 200 Cc., such as is commonly used in removing wax from the ear) until pain is produced by the

FIG. 8 B.



Schematic drawing of the bag: a, rubber tube; b, thread; c, hole in tube; d, Penrose drain; e, silk bag; f, Penrose drain (actual size); g, closed end.

hydrostatic pressure. It has been my experience that patients can stand the pain of a fully dilated bag for ten to fifteen minutes with very little discomfort, after a few short preliminary treatments, which are necessary to accustom them to retain a fully dilated bag.

Treatments are given daily, or twice daily (morning and evening), if the severity of the condition demands it, for the first three or four days. The treatments are gradually reduced in duration and frequency as defecation approaches the normal, and stopped when the patients report satisfactory daily evacuations for one week. Then they are allowed to go for one week without any treatment, and if they still report satisfactory daily evacuations the treatments are

¹⁴For want of a better name I have suggested calling this apparatus a "Hydrostatic sphincter dilating bag."

¹⁵Silk bags made of three sizes (same diameter as Nos. 8, 10, and 12 Wales bougie) mostly used, depending upon the size of the patient and the severity of the condition.

discontinued permanently, but given again on the first day they do not have a normal stool. Usually only ten to twenty treatments are necessary to secure permanent relief. The number of treatments depends upon the severity. The normal tone returns to the over-stretched sphincter by the time the muscular tone of the rectum is restored if the rectum is massaged with Hirschman's apparatus. The rectal massage treatments are given immediately after the dilating treatments, discontinuing them so soon as the condition permits, but continuing the treatments with Hirschman's apparatus until the patient is cured.

This method of treatment for protracted cases of tetanically contracted and hypertrophied external sphincters associated with chronic habitual constipation has given results of a character and permanence that were far beyond my fondest expectations. This method has, moreover, the advantage of being simple and harmless and far more practical and effective than manual dilatation under a general anæsthetic, which is always attended with great danger.

ACCESSORY TREATMENT

In addition to the routine method of treatment outlined for chronic habitual constipation, there are certain forms of mechanical muscular exertions that are not sufficient, as a rule, to constitute a "*cure*," which should be recommended to those patients having certain conditions that by their presence aggravate the constipation. These accessory measures will play a bit of a part in alleviating the constipation by removing the condition, thus increasing the efficiency of our routine method of treatment and thereby making the cure permanent.

Persons of sedentary habits who suffer from chronic habitual constipation cannot produce the requisite rise in intra-abdominal pressure when their abdominal muscles are weak and their respiratory excursions deficient. This condition is commonly present in the aged and obese, because they do not take any natural exercise, *e.g.*, walking and riding. Such patients should be instructed to take regular, systematic exercise, which is an essential accessory form of treatment in these cases. Exercise hastens the successful result and prevents the recurrence of the constipation by strengthening the voluntary muscles of defecation and producing rapid changes in the intra-abdominal

FIG. 10.



Method of exercise suggested.

FIG. 11.



Method of exercise suggested.

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pressure, thereby stimulating the intestinal movements. It also increases the appetite and has an important mental effect, taking the thoughts away from business cares and household worries, because any depression in the nervous system is an important factor in aggravating many of these cases of constipation.

Natural exercise in the open air is most desirable. Walking, rowing, swimming, golf and tennis playing, and horseback riding are effective forms of exercise. In a majority of patients these forms of exercise are impossible, because many of them are either seasonable or unavailable for pecuniary reasons. They cannot be suggested in the average case, for it is regularity that makes them helpful. Consequently, as a rule, some simple, efficient, available routine plan must be devised that every patient can take advantage of. The following method (Fig. 10) gives excellent results in these cases: On a secluded veranda, preferably outdoors, the weather permitting, let the patient lie flat on a couch, then rise slowly to a sitting posture, with the arms folded, then slowly return to the prone position. This plan for strengthening the abdominal muscles may be varied. The patient is instructed to stand erect and bend forward, striving to touch the floor with the finger-tips without bending the knees (Fig. 11). These exercises should be repeated twenty-five times, morning and evening. The effect of either method on the abdominal muscles is prompt. It is gratifying to know how hard and strong the muscles become. In those individuals not accustomed to exercise it is wise to begin a mild form for short periods, and gradually to increase its severity as the patient becomes accustomed to the exercise; it is very important to avoid taking too much or too violent exercise, as the harm produced by the great fatigue more than outweighs the good done by the exercise.

In this connection reference may be properly made to the value of an abdominal binder in these cases of chronic habitual constipation where visceroptosis or obesity is present; a well-fitting abdominal binder is very helpful, because it acts as a support to the organs that have prolapsed, and at the same time it braces the wall of the abdomen, which hastens the beneficial effects of systematic exercise by preventing extreme relaxation of the abdominal muscles.

When chronic habitual constipation is caused or aggravated by the want of activity or congenital weakness of the intestinal muscu-

lature great satisfaction will be found by giving abdominal massage. Still better results can be obtained from vibratory abdominal massage when given in connection with the routine treatment. A few treatments properly given (Fig. 12) will generally cause immediate evacuation of the bowel, because the muscular tone and secretory activity of the intestines are improved by exerting a direct stimulating action upon the bowel and other underlying organs. Abdominal massage is also valuable in those cases aggravated by weak abdominal muscles, by imparting strength and tone to them. Massage, however, in these cases is not so effective as the exercises.

FIG. 12.

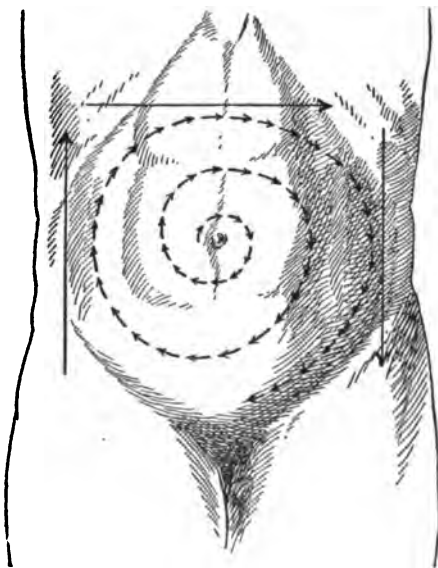


Illustration showing proper course of abdominal massage. Operator stands at right of patient and carries the manipulation along the course of the large intestines,—i.e., beginning at lower right side, passes up, across, and down.

Massage is given with the patient in a recumbent posture and the knees raised by a pillow in order to relax the abdominal muscles as much as possible, the bladder being previously emptied. It should be given daily, preferably in the morning before breakfast, when the stomach is empty. The massage is thereby added to one of the natural morning stimuli of defecation, which soon cause an evacuation immediately after breakfast. If it is impossible to give the massage in the morning, it should be given on retiring for the night.

Its duration at first should not exceed five minutes, but it can gradually be increased to thirty minutes, always stopping when the patient complains of fatigue. As the condition improves the duration and frequency of the massage should be gradually reduced. It is also of value to give, at the same time, vibratory massage along the lumbar sacral region, over the centres in the cord that control the nerve impulses of defecation. Massage should never be given if it causes pain, or when there is any evidence of an underlying inflammatory complication, or just after eating a full meal.

Abdominal massage requires some degree of special technical knowledge of the abdominal anatomy. Unless it is given by a physician or competent masseur, it is useless and positively harmful at times. To attain the desired results vibratory massage, when skilfully given, is more efficient than hand massage. Vibratory massage is far less laborious to the physician and less fatiguing to the patient.

Hydrotherapy also has its place in the treatment of chronic habitual constipation, especially in those cases where the circulation is a little below par. The morning bath or shower, acting as a tonic to the whole system, has a valuable influence on peristalsis, which results from the stimulating effect on the circulation. In some patients cold compresses applied to the abdomen appear to stimulate reflexly the muscular coat of the entire alimentary canal. The best results are obtained when the compress is put on the abdomen the last thing at night and removed on arising. This is exceedingly beneficial in some cases. The spinal spray is an excellent tonic procedure; it increases the functional activity of the spinal cord, and makes the centre of defecation more responsive to the normal stimuli. Best results from hydrotherapy are obtained when used in conjunction with the morning exercises.

My experience has also convinced me that the efficiency of the routine treatment may be increased in certain cases by the use of paraffin oil and agar-agar, if judiciously used, when the proper indications are present. The normal function of defecation is aided by producing a stool of normal size and consistency. Paraffin oil and agar-agar are unirritating and act in the nature of an undigestible ballast, passing through the gastro-intestinal tract practically unaltered, each having its own special indication.

In cases of chronic habitual constipation, complicated by intestinal

stasis or visceroptosis, which from age or obesity becomes difficult to correct, because of the persistent lack of exercise, the internal administration of paraffin oil, in my experience, adds to the efficiency of the routine treatment by lubricating the bowel, softening the fecal mass and rendering it slippery to facilitate its onward passage to the rectum and ultimate expulsion. While paraffin oil, by its mechanical action, may accomplish good results in selected cases, it should not be forgotten that it is, after all, a foreign substance and was never intended for the human economy. Its continued use will sooner or later nauseate and produce a revolting aversion in most people. In those inclined to obesity, who are heavy eaters and suffer from chronic habitual constipation, the administration of paraffin oil usually retards nutrition by covering the alimentary tract with a thin film, so that it not only retards gastro-intestinal digestion but also prevents the proper absorption of the products of digestion, and so prevents further increase in obesity. Its dose and frequency are determined by individual equation. The average dose is between one drachm and two ounces three times a day. As the condition improves, the dose and frequency should gradually be reduced.

Sedentary life, lack of exercise, and the use of concentrated food may cause chronic habitual constipation by producing atony of the bowel, which is also frequently observed in young anæmic individuals suffering from constipation. When atony of the bowel produces constipation it is often aggravated by the formation of hard fecal material in small amounts. According to the investigations of Schmidt,¹⁶ the small quantity of fecal material produced when atony of the bowel is present results from the food being overdigested, and, to quote him exactly, "In cases of chronic habitual constipation the food is overdigested, as compared with normal conditions, and that, as a result, the fæces are insufficient in quantity and of too hard a consistency."

Agar-agar, administered when the above condition is present, greatly increases the efficiency of our routine treatment, adding bulk to the fæces and softening them at the same time by its inherent property to absorb many times its own weight of water. The fæces are kept uniformly moist and bulky, thus aiding the intestinal contents to develop their own activity necessary to produce a healthy evacuation. Agar-agar does its work without molesting any organ or func-

¹⁶ Schmidt, A., *Münchener medizinische Wochenschrift*, Nr. 41, 1905.

tion, and may be given over a long period of time. The dose of agar-agar is one to two heaping tablespoonfuls, to suit the individual case, to be taken morning and evening. It may be eaten with milk or cream or mixed with any of the ordinary cereal breakfast foods or desserts, with the addition of salt or sugar to make it palatable, as it is tasteless; gradually reducing the dose and frequency as the condition improves.

During the routine treatment the use of cathartics and enemata (except the ones that initiate the treatment) is strictly enjoined. It is a well-known fact that the routine treatment with drugs, no matter in what form administered, has really never cured a case of chronic habitual constipation. The indiscriminate use of cathartics and enemata frequently does harm because of the unfavorable effects on the tissue itself. These drugs irritate the intestinal mucosa, causing the exhausted cells to produce increased secretions and excessive peristalsis, which results in increased tissue relaxation. The relief is only transient. An increased degree of constipation results from their use. Usually larger doses of the same drug are required to get a result, until repetition causes it to lose its effect, so that a more drastic purge is needed for another evacuation, till finally, in some cases, the purgatives cease to act at all.

It should be borne in mind that long-standing cases of chronic habitual constipation sooner or later interfere with the normal sequence of processes in the gastro-intestinal tract; the different parts of the alimentary system have such close physiological connection that the disturbance of one function usually causes a depression all along the line. Under such circumstances it is often found necessary, in those patients who complain of symptoms referable to intestinal indigestion, to administer those remedies that will help to restore the normal physiological equilibrium of the alimentary tract. My experience has been that this is best accomplished by the hormone or organotherapy, because their products are native to the tissues where they are used and vastly superior to medicaments that naturally have no place in the normal physiology of the alimentary system.

In those patients who suffer from intestinal indigestion resulting from chronic habitual constipation the administration of secretin in five- to ten-grain doses after meals has, in my experience, been of great value in relieving these symptoms. Probably the splendid re-

sults obtained can be best explained by the results of Starling's observations.¹⁷ He has conclusively demonstrated that intestinal indigestion in these cases is due to the interference with the normal production of secretin, which normally stimulates the muscular tone and secretory activity of the intestines, liver, and pancreas, and at the same time stimulates its own production in the duodenum.

In patients who have a torpid liver and marked symptoms of auto-intoxication due to intestinal putrefaction the administration of bile is the remedy *par excellence* as a rational restorative measure, since it is actually the missing element and the best cholagogue we have. I have found that beneficial results are obtained by the administration of three to five grains of the repurified and vacuum-dried extract of bile three times a day, given until the foetid odor of the stools is controlled and their consistency and regularity brought to normal. With these changes there is naturally a regulation of the toxic manifestations, color of the skin, and health in general.

In cases of chronic habitual constipation aggravated chiefly by dietetic errors, where intestinal putrefaction is due to the ingestion of excessive amounts of proteids, the administration of *Bacillus bulgaricus* tablets or the culture which comes in vials, or encouraging the free use of buttermilk or the artificially-soured milk, will restore the bowel to its normal condition. This is brought about by the production of lactic acid, which produces a change in the bacterial flora of the intestinal tract.

CONCLUSIONS

Theories and opinions may aid and guide us in finding a remedy, but our final judgment as to the value of any remedy in a disease must be based on the results alone, obtained by practical experience in using the remedy in a number of cases over a long period of time. If cases of chronic habitual constipation are properly diagnosed and the diets, alimentary habits, and local conditions corrected, the results from the routine method of treatment will be very satisfactory, even in the most obstinate cases of years' standing, as is attested by the experience of many physicians who use this method in many cases. Its usefulness lies in the fact that it relieves the constipation by correcting the underlying cause.

¹⁷ Further interesting references to this whole subject will be found in Starling's "Principles of Human Physiology," 1912, p. 797.

THE PRESENT STATUS OF DIGITALIS THERAPY *

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ONE hundred and thirty years have elapsed since digitalis was introduced into medical practice, and, while it might seem as though so long a period of use should have afforded abundant opportunity for us to have become fully familiar with all of the problems of the actions and uses of this drug, such is not the case—a fact too patently obvious to need discussion. The reasons for our present only fragmentary knowledge regarding this drug and its allies fall into several classes. We first have the fact that with the introduction of any new remedy many fallacies promptly spring up from its employment in a great variety of conditions in which its actions are not of therapeutic value. Such fallacies arose in considerable number in connection with digitalis, and we are only now beginning to come to their appreciation. The second reason for our defective knowledge lies in the fact that we had not until recent times any adequate conception of either cardiac physiology or pathology. The third reason is that in spite of the vast amount of clinical and pharmacologic work which has been done with digitalis and its allies there has been too little attention paid to the correlation of the pharmacologic observations with those of the physiologist, the pathologist, and the scientific clinical observer. A fourth source of considerable misunderstanding has been the perpetuation by manufacturers of digitalis specialties of incorrect statements concerning one or more of the actions of the drug for reasons of financial gain.

The task which lies before us, then, is to discuss certain of the advances in our knowledge of the actions and uses of this class of drugs which have been made in more recent years. No effort will be made to enter into an exhaustive consideration of any single problem, but we must be content with a presentation of prevailing ideas on both sides of any of the questions and with here and there a sug-

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gestion as to how opposite views may be reconciled, or with a remark on the more obvious fallacies of one or another argument. Only the more important original articles will be referred to, but a more extensive bibliography may be found by those interested in any of the subjects treated in one or more of the papers here cited.

ACTIONS OF DIGITALIS

If therapeutics is to be rational it should be based upon a knowledge of the action or actions of the therapeutic agent and the physiology and pathology of the condition which is to be treated. The actions of digitalis, in so far as it affects the circulation, may be briefly stated as follows:

1. It increases the force of cardiac systole.
2. It increases the volume of blood expelled by each systole.
3. It slows the heart, mainly by lengthening the diastolic interval.
4. It alters the distribution of the blood and its rate of flow in the several portions of the body, probably solely as the direct result of its three main actions first stated.
5. It is reputed to have actions, both direct and indirect, upon the blood-vessels whereby constriction and dilatation are believed to occur simultaneously in different portions of the body.
6. It is reputed also to have some stimulant action upon the renal functions.

In addition to these actions which are of therapeutic value in the treatment of cardiac disease, its use is associated with certain side actions of considerable importance, viz., the production of nausea or vomiting; the appearance of diarrhoea in some cases and the development of troublesome headache in others.

The increase in the force of cardiac systole and in the volume of blood thrown out at each contraction is probably due mainly to a direct action on the heart, as was well shown by the experiments of R. Gottlieb and R. Magnus¹ upon the isolated heart of the cat. These observations have been so abundantly confirmed as to warrant their acceptance. To this direct cardiac action there should also be added the slowing produced by vagal stimulation which contributes to the increase in the volume of blood expelled with each systole by prolonging the diastolic phase and increasing diastolic dilatation of the ventricles.

The slowing of the heart which is produced by all digitalis bodies under suitable conditions has been attributed entirely to an action of the drug upon the vagus mechanism, probably mainly centrally. Recently, however, evidence has been brought forth suggesting that there may be some direct cardiac action of the drug by which a certain degree of slowing is produced. Cushny, Marris and Silberberg² have shown that in patients, both with normal rhythm and with auricular fibrillation, in whom the heart had been slowed by digitalis the subsequent administration of a dose of atropin sufficient to paralyze the cardiac vagal endings did not restore the heart-rate to the point to which an initial dose of atropin, before digitalis, had raised it. Just how important a rôle is played by this mechanism of digitalis slowing has not yet been determined, but it seems probable, from the study just cited, that it is relatively far less important than is that produced by stimulation of the vagus.

The slowing brought about by digitalis is of two distinct types as revealed by cardiographic studies. The one involves the whole heart, leaving the ventricular contraction to follow in its normal sequence upon that of the auricles. In this form of slowing the pulse may be regular, or it may show some degree of more or less rhythmic increase and decrease in rate—sinus arrhythmia. This type of irregularity is commonest in youthful individuals, and is evident only in hearts which were previously regular or which already showed some degree of this form of arrhythmia before treatment.

The second type of slowing produced by digitalis is due to some degree of interference with the conductivity of impulses through the auriculoventricular bundle—heart-block. It is not improbable that two mechanisms are concerned in the production of this phenomenon. It has been shown that any effective stimulation of the vagus is capable of producing heart-block, and it is probable that the action of digitalis upon the vagus is largely responsible for its production in the course of the administration of this drug. Again, however, the observations of Cushny and his associates already cited suggest that there may also be some local direct action of the drug by which conductivity is depressed. In the present state of our knowledge it is impossible to make a definite statement in regard to this action.

The alteration in the rate of blood flow and in the distribution of the blood in the various organs and tissues of the body has been a

field in which speculation has been rife, and at times even fanciful. Accepting for the moment that therapeutic quantities of digitalis do not raise the systolic blood-pressure to any constant or appreciable degree, we are almost forced to believe that there must be some alteration in the distribution and rate of flow of the blood to account for the diuresis and disappearance of fluid from the tissues in œdematous patients, and for other phenomena frequently observed. The increase in the force of the heart-beat and in the volume output per beat would seem to be quite sufficient to account for such changes in the blood flow as would be required to produce any of these beneficial effects, and the need for invoking any elaborate hypothesis for their explanation is not apparent.

The reputed actions of the drug upon the vascular system merit some discussion. Two camps have arisen on this mooted subject. The larger one holds that the vascular actions of the drug are marked and of great importance. The other, and much smaller one, holds a diametrically opposed view. It has been shown by the first school, of whom Gottlieb is one of the strongest supporters, that the several digitalis bodies are capable of causing marked vasoconstriction in animals with an attendant great rise in blood-pressure. This has been proved to be due to a direct action of these substances on the vessels themselves, both in the intact animal and in isolated perfused vessels. Gottlieb and Magnus³ have also shown that in dogs there was a reflex vasodilatation in the peripheral vessels simultaneously with the splanchnic constriction, though this was seldom observed with digitoxin. Oswald Loeb⁴ has shown that the vasoconstriction extends even to the coronary arteries in animals. Others, including Jonescu and Loewi,⁵ have attempted to show that there is a local renal vasodilatation produced in rabbits by digitalis and its congeners. The one great fallacy which runs through practically all of these experiments on animals and excised vessels is the fact that the doses of the drugs used were always far above those possible in the therapeutic use of the drug, in many instances even being far over the fatal dose for the animal employed. In the course of a large number of experiments performed in our laboratory on cats and dogs, in which the fatal dose of one or other of the digitalis bodies was slowly injected into the vein, we have never seen more than a slight transitory and hence unimportant rise in the blood-pressure during the injection.

Just before death there is often a marked rise in the blood-pressure, but it is asphyxial and in no way due to any direct effect of the drug.

Mackenzie,⁶ Price,⁷ and others have shown by observations on man that the administration of the digitalis bodies to the point of maximum tolerance is not associated with any constant rise in the blood-pressure. On the contrary, a slight fall was rather more frequent than any rise. In my own experience, even when using pure digitoxin to the point of tolerance, I have failed to see any constant effect on the blood-pressure, the alterations observed falling well within the normal limits of diurnal variation.

We may conclude our brief discussion of this question by saying that it seems probable that very large doses of the digitalis bodies given by vein to animals, or relatively very concentrated solutions of them perfused directly through isolated vessels, are capable of causing more or less marked vascular constriction by direct action. Such quantities and concentrations, however, can never be concerned in the therapeutic use of the drug, and careful clinical observation shows that its therapeutic use is, in fact, not associated with evidence of vasoconstrictor action.

So far as the sixth point is concerned at the present time, it can only be stated that there is not sufficient evidence for the belief that digitalis has any direct action on either the renal epithelium or the vessels of this organ. The diuretic action is seldom seen in normal animals or men, and in the cases of cardiac dropsy, in which the greatest diuresis from the drug is encountered, the known beneficial cardiac actions seem quite sufficient to account for the increased urinary output.

The therapeutic use of digitalis, in the present state of our knowledge, rests, therefore, upon its three proved actions: (1) To increase the force of cardiac systole; (2) to increase the output of blood per systole; (3) to slow the heart, either directly or through the vagus, or by both actions simultaneously.

So much able work has been done in the last few years, dating from the publication of Mackenzie's epoch-making work,⁸ on the various cardiac conditions in which the use of digitalis might be expected to give favorable results, that I shall pass over this phase of our subject with very brief remarks.

It may be stated in a few words that digitalis is indicated only in

cases in which there is evidence of failure of cardiac compensation. This includes cases with auricular fibrillation, particularly of rheumatic origin, and cases with regular rhythm, or at least having the heart under the control of the normal pacemaker, in which there is some degree of dilatation or other evidence of a failure of the muscular power of the heart to carry on its function normally. The less common condition of auricular flutter also seems to respond particularly favorably to the intensive administration of digitalis. It is to be borne in mind that not all cases coming within either of the first two classes will respond favorably to treatment. Those which are least likely to do so are the cases of auricular fibrillation which have had many breaks in their compensation and such as have developed late in life in conjunction with general degenerative changes in the circulatory system. In the second class more failures will be encountered than in either of the others, and, in fact, it has been held by some that digitalis is of relatively little use in this class of cases. To this latter idea I cannot subscribe, for personal experience leads me to believe that a very considerable proportion of these cases respond quite satisfactorily to intensive digitalis treatment, and a further number show sufficient improvement to make the treatment more than warranted. Inasmuch as there seems to be no way of foretelling whether a patient in this class will respond or not, it would seem wisest to give each the benefit of the doubt and submit him to a thorough course of the drug.

There is one class of patients in which digitalis would seem to be indicated but in which its use, unfortunately, is of little or no value. This includes those whose hearts are showing signs of failure in response to the effects of an acute intoxication, as in tuberculosis, pneumonia, and other acute infections, and in cases of exophthalmic goitre. The evidence on this point seems so conclusive as not to admit of discussion as to its validity.

Statements to the contrary notwithstanding, there seem to be no definite contra-indications to the use of digitalis in a case of cardiac failure. Certainly the existence of a valvular lesion, irrespective of its nature, except an acute infective endocarditis, is *per se* neither an indication nor a contra-indication for the use of the drug. It having been shown that the therapeutic administration of digitalis does not cause any appreciable increase in the blood-pressure, the old idea that arteriosclerosis or hypertension was a contra-indication does not seem

well founded. Digitalis is frequently given in such cases, and ill-effects from its use have not been reported.

Since digitalis is capable of producing heart-block or of increasing a preëxisting tendency to this condition, the statement has been made that it should not be given to persons already showing a lengthened conduction time or a partial heart-block. Experience has taught us, however, that it may be given to such cases without harm if they show signs of failure of the heart which demand its use. The danger associated with some degree of increase in the block is more than outweighed by the beneficial effects produced by the drug where the heart is incapable of meeting the demands thrown upon it.

In the absence of evidence that digitalis exerts any stimulant action on the kidneys, and in view of the fact that it does not cause diuresis in normal animals, or in man in the absence of cardiac incompetency, its use in cases of nephritis is unwarranted unless there is some measure of cardiac insufficiency.

Evidence of some degree of failure of the heart to carry on its work efficiently, in brief, constitutes the one indication for the exhibition of digitalis, and in the absence of such evidence we have no rational basis for its administration.

SIDE ACTIONS

The most troublesome of the side actions of this drug is probably that by which nausea or vomiting is produced. It has long been held that these effects are due to an irritant action of the digitalis bodies upon the gastro-intestinal tract. This idea rested largely upon the fact that all of the members of this group were known to be irritant when injected subcutaneously. Clinical observation should have shown the fallacy of this argument, for neither nausea nor vomiting appears before a considerable quantity of the drug has been given, and simultaneously with their onset there is practically always definite evidence that enough of the drug has been absorbed to exert some action on the heart. Dr. Hatcher and I^{9,10} have recently shown that in dogs both nausea and vomiting are solely of central origin, resulting from a direct stimulation of the vomiting centre. I¹¹ have also been able to show that such is almost certainly the case in man, for it can be proved that these phenomena appear in the great majority of cases only after considerable of the drug has been absorbed.

Since the publication of this paper I have repeatedly given single oral doses of from 8 to 15 Cc. (2 to 4 drachms) of the tincture of digitalis without ever having seen either nausea or vomiting ensue.* The same explanation, viz., central action, almost certainly accounts for the diarrhoea which is sometimes produced by digitalis and its allies. No one has doubted that the headache occasionally encountered is also of central origin.

On the belief in the local irritant action of the drug as the causation of the gastro-intestinal symptoms it has been commonly advised that these actions might be avoided by adopting some other mode of administration. Since it has been shown that the action is one resulting only after the absorption of the drug, such a practice becomes obviously irrational. Equally irrational is the resort to some other member of the group when nausea or vomiting has resulted from the use of any given preparation, for all digitalis bodies share this central action to a greater or less extent.

The nausea or vomiting can, however, be avoided in a large proportion of cases while the full therapeutic action of the drug is yet secured. This is possible only by the careful and frequent observation of the development of the action of the drug so that one can stop its administration so soon as the therapeutic effects have been secured. Even with such careful observation of the patient one will meet with failure in some cases.

DOSAGE, ADMINISTRATION, AND PREPARATIONS

Dosage.—This question is in a state of considerable confusion, and a perusal of the literature shows the widest divergence of opinion as to the proper amounts of digitalis for administration to man. Few seem to have approached the solution of this problem, and most have been content to say that enough should be given to secure the desired effects or to produce some of the symptoms calling for its withdrawal. I have recently attempted to throw some light on this subject and have found, from a study of forty-seven patients receiving digitalis or digitoxin, that there is a fairly constant dose of the drug based

* Such large doses as this must not be used unless one is certain of the activity of the preparation and unless one is prepared to make frequent graphic and clinical observations to prevent the administration of an overdose. They are certainly not suitable for use outside of a hospital where the patient can be under the constant care of a trained observer.

upon the weight of the patient and the activity of the preparation. Briefly, it was found that about 15 mgm. ($\frac{1}{4}$ grain) of a first-class digitalis leaf or 0.15 Cc. ($2\frac{1}{2}$ minims) of tincture was required for each pound of body weight to produce full therapeutic effects. Approximately half of all of the patients studied responded to a dose within fifteen per cent. either above or below this average. It is to be borne in mind that specimens of digitalis vary considerably in their activity, and that this dose applies only to an average high-grade specimen. The actual study was made upon the basis of activity of the specimen used as determined by the cat method of standardizing devised by Hatcher.¹² Inasmuch as this method is not in common use among manufacturers and purveyors, it has been deemed best to state the dose here in terms of an average leaf of high grade. We have found in our laboratory, by tests of many such samples, that they do not vary very widely from an average activity, it being only the exceptionally active leaf or the poorer specimens which fall wide of comparatively narrow limits.

Administration.—Except in the most urgent cases there is no apparent reason for giving digitalis in any other way than by mouth, for by this method, and with a suitable adjustment of the dose, the full therapeutic action can be secured in from twenty-four to forty-eight hours. To bring the patient under the full effects of digitalis in so short a time, however, one must give large initial doses—up to 4 to 8 Cc. (1 to 2 drachms) of the tincture—rapidly reducing the subsequent doses so that the last few are only small fractions of the total amount required.* Where even more rapid action is desired, as in very urgent cases, resort should be had to the intravenous or intramuscular administration of one or two doses of ouabain (crystalline strophanthin) or strophanthin (amorphous). The former may be given in an initial dose of 0.5 mg. ($\frac{1}{16}$ grain), and half this amount may be repeated, if necessary, in from six to twelve hours. The dose of strophanthin is from 0.75 to 1.0 mg. ($\frac{1}{8}$ to $\frac{1}{6}$ grain), half to be repeated as above if required.

The administration of digitalis to any patient should be pushed to the appearance of the symptoms of the minor toxic actions of the drug, or until the full therapeutic effects have been secured. In any case, but especially where it is desired to bring the patient rapidly

* See footnote on p. 94.

under the influence of the drug, the patient must be watched carefully and frequently during the course of the administration to discover the signs of the toxic actions of the drug at their earliest appearance. Clinical observation must always be supplemented by polygraphic or electrocardiographic records taken at frequent intervals in such cases. The later toxic manifestations, as shown by Bailey,¹⁸ resemble so closely those often seen in failing hearts in cases in which no drug has been given that they are likely to be confused with them and the patient may be thought in need of more digitalis. Further administration in such a case might well result fatally from the effects of the drug itself. Such has doubtless occurred more than once without the true cause of death having been suspected. The criteria of the toxic actions of digitalis have been abundantly discussed elsewhere and can only be enumerated here.

1. Nausea, vomiting, diarrhoea, headache.

2. Irregularity in a previously regular heart due to (a) sinus arrhythmia, (b) partial heart-block, (c) extrasystoles, (d) combined effects.

3. Heart-block of marked degree, extrasystoles, or coupled rhythm in auricular fibrillation.

4. Auricular fibrillation in regular hearts, and excessive rate in hearts with either normal rhythm or with auricular fibrillation.

Preparations.—Since the capacity of stimulating the central vomiting mechanism is inherent in all members of the digitalis group we cannot look for a preparation devoid of this action yet possessing the desired action on the heart. Inasmuch as the therapeutic administration of digitalis is apparently not associated with a rise of blood-pressure or vasoconstrictor effects, no choice of preparation can be made in this respect. Really high-grade digitalis leaves are but little more costly than the inferior varieties and are of reasonably uniform activity, so that good galenical preparations should be readily obtainable. Several practical methods of standardization have been devised, and many standardized tinctures, the activity of which is assured, are now on the market. As both dilute alcohol and water are capable of completely exhausting the leaf of its active principles, both the tincture and the infusion have precisely the same action as the leaf itself. The tincture seems to have two advantages over the infusion: First, that it is easier to approximately exhaust the leaf in its preparation

than is the case with the infusion if this is made according to the pharmacopœial directions; and, second, that the infusion has some tendency to deteriorate if kept long, though this is not so great as usually supposed. The galenical preparations of digitalis then fulfil all of the requirements of any preparation for oral administration, and there is no obvious advantage in the several specialties and proprietary preparations, so far as this mode of administration is concerned.

For intravenous or intramuscular administration we have two substances of constant composition and activity in ouabain and strophanthin, both of which are cheap and easily prepared for hypodermic use (intravenous or intramuscular only). Here, too, there seems to be no advantage in resorting to the use of any of the more expensive proprietaries, some of which are by no means constant in activity, although such claims are made for them. There does not seem, therefore, to be any adequate reason for employing any digitalis preparations other than those which are official in the pharmacopœia, and ouabain and strophanthin which are not proprietary.

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- ⁹ *Jour. Pharm. and Exp. Therapy*, 1912, iv, 113.
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- ¹¹ *Am. Jour. Pharm.*, 1910, lxxxii, 360.
- ¹² *Am. Jour. Med. Sc.*, August, 1911

Pædiatrics

MILIARY TUBERCULOSIS IN NEW-BORN; CONGENITAL DIAPHRAGMATIC HERNIA; DEMONSTRATION OF X-RAYS AND PHOTOGRAPHS; HIRSCHSPRUNG'S DISEASE

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MILIARY TUBERCULOSIS IN THE NEW-BORN

I WILL show you a specimen of miliary tuberculosis in the new-born. The mother of this baby entered the Cook County Hospital in August, 1912, and was transferred to the woman's venereal ward because of a vaginal discharge which on microscopic examination did not prove to be gonorrhœa. The history was negative, with the notable exception that she had tuberculosis of the hip, but she had no active tuberculosis so far as we knew. She gave birth to a baby on the 6th of September which weighed six pounds and eight ounces. The child had a fair degree of nutrition. The temperature curve of that child is interesting, although I do not know that it means very much, but I will pass it around for what it is worth. It will be noted from the second day the child ran an irregular temperature of from 96° F. to 105° F. During the first night the baby was very cross. On the sixth day I saw the child, at which time it was having twitchings and convulsions. On examination there was very little to be seen except that we had a sick baby with an enlarged liver and spleen. There was no evidence of any infection about the umbilicus. I hesitated in my diagnosis between septic infection and a combination of syphilis and intracranial hemorrhage. The convulsions did not start until the fifth or sixth day, which was rather late to expect the beginning of intracranial hemorrhage. On the eleventh day the child died, and fortunately we were able to get an autopsy. I show you the lungs, the kidney, and spleen. You will notice around the portal vein just below the

liver some large nodules which were distinctly caseous, some of them as large as the end of my pencil. The spleen is thoroughly studded throughout with white nodules. On the surface of the lungs there are nodules. On one side you will see an occasional nodule in the kidney. The liver shows quite a few. The heart shows none. There was no involvement of the bronchial lymph-glands. Here, then, we have a caseous miliary tuberculosis in a child that died on the eleventh day after birth.

There have been reported some eleven cases in children who soon after birth showed signs of tuberculosis. Of these eleven cases, only seven will bear the limelight, because three or four of them were cases where there had been found only tubercle bacilli, and nothing further. Of the eleven cases, there is only one that presumes to have any clinical history. Practically all the rest are cases of which post-mortem findings alone are given. Lobenstine, of the Lying-in Hospital of the City of New York, reports one case in which there was absolutely no rise of temperature whatever. On the other hand, in his case the baby was premature, and it is not surprising that the child showed no rise of temperature, since you all know premature babies and babies congenitally debilitated may show marked infection without any rise in temperature.

There is this one small point about the history of my case: It is the only case on record where a child has died and the mother remained apparently in good health. We know that for several months after the child died and the mother left the hospital she was alive and apparently well. It is very likely, although we did not have the discharge examined, that she had tuberculosis of the uterus, and this discharge or leucorrhœa was due to that. But she had nothing but an old healed tuberculosis of the hip apparent clinically. In every other case the child died two days before the mother, or two or three days afterward.

I cannot tell you anything about the placenta in this case. The placentas are not examined here as regularly as we would like to have them, and we do not know what the placenta showed. There are several cases on record where children have lived up to six or twelve months without showing any signs of tuberculosis, in spite of the fact that the placenta was tubercular. I think it is fair to assume that this is unquestionably a case of congenital tuberculosis.

The chief points are that the condition is primarily an abdominal one, and the first glands affected are those about the liver, and that the abdominal organs are most affected. We have here marked caseous tuberculosis, and the child dying on the eleventh day. I think you will agree with me that even though we consider the slight resistance the infant has to tuberculosis, it would hardly reach this stage in less than eleven days.

CONGENITAL DIAPHRAGMATIC HERNIA; DEMONSTRATION OF X-RAYS
AND PHOTOGRAPHS

The next case is that of another new-born baby, the history of which does not concern us very much, except that I received the information that we had a case of dextrocardia in the obstetrical ward and I wanted to examine it, as I had never seen one. I remained rather sceptical as to the diagnosis, in spite of the fact that the apex was apparently on the right side and there was heart dulness. Over the lungs there was a resonant note which I could not distinguish from the normal lung resonance in a child of that age. We had an X-ray taken, with the result shown. Over at this point (indicating) is the heart. About here is an area of clearness evidently different from the corresponding area on the opposite side. The heart is apparently, as you will observe, on the right side, but it is pushed over with the base of the heart to the right and the apex near the median line. There is a mass filling up the left side of the chest which is penetrable to the ray and which contained a certain amount of air. With this evidence I suggested the possibility of the case being one of diaphragmatic hernia, and this it proved to be.

The abdominal findings in this case were confusing. You could palpate both the kidneys. The liver was away down and the spleen was down. That will be explained by the picture. The first picture was taken with the anterior thoracic wall present. You will see the liver coming away down in this region, and the spleen is away down here (indicating). The stomach is away off in this region. You can see a considerable part of the large intestine.

The second picture shows you the result of removing the anterior wall of the thorax. You see the liver still down; the spleen is over here, the stomach is at this point, and the small intestine is pulled up in this region and filling the whole left side of the thoracic cavity.

FIG. 1.



Showing body with anterior wall of thorax before removal.
Note position of stomach, spleen, and liver.

FIG. 2.



Showing tube passed through diaphragmatic defect. Note small
intestines in left side of thorax.

1140

The next picture shows a tube passed through the opening in the thorax, passing up in the posterior part of the left side of the diaphragm, and that will give you a fair idea of the size of the opening.

I find that these diaphragmatic hernias are not so uncommon. One writer has recently collected 450 or 500 cases, and of this number this type is the most common. The cases are divided into two main types, the true and the false. The true type is covered with a mucous membrane with peritoneum, and this is more uncommon than this type which is not covered with peritoneum. Of the two types this condition occurs far less frequently on the right than on the left side. The left-sided false hernias are the most common, constituting some 400 out of the 475 cases collected.

It seems to me there are two or three things by which we can improve our diagnosis in cases of this sort. One is by giving bismuth. If this child had been given bismuth we would have found the intestine was up in the thoracic cavity. The next time I see a case of so-called dextrocardia I shall think of diaphragmatic hernia more than I did at the time when I saw this case.

HIRSCHSPRUNG'S DISEASE

The boy whose case I am going to report died last Sunday in an attack of convulsions, and I have nothing more than the X-ray of the condition to show you. This child came in with about the following history: He was fifteen months of age, and gave a history of constipation. Since May the bowels have not moved even with catharsis, except when soap suppository was used. The stools were yellow, and there were bowel movements after the use of soap suppositories every third day. There was no blood in the stool.

On examination of the child we found an enormously large abdomen, as this picture will show. This you will see very clearly, in spite of the fact that we did not get the bismuth well up into the colon. The colon is markedly enlarged and seemingly takes up the whole of it, and is most marked in the region of the sigmoid. There was a very distinct peristalsis along the line of the colon.

Here is a specimen which Dr. Helmholtz was kind enough to let me take which shows an enormously enlarged colon. The specimen is rather interesting to me from two or three standpoints. One is, the condition is double. In the first place, the ascending and transverse

colon are markedly dilated; then at about the splenic angle there is retention, evidently a sort of kink, and this going into the sigmoid, which is markedly dilated. The sigmoid, on the other hand, does not show any abrupt change except at the point which you see. It seems as if there is a sort of valvular formation here. To my mind this double condition is a very interesting one. The diagnosis of Hirschsprung's disease is made chiefly on three points; namely, the enormous enlargement of the abdomen, the presence of constipation of very marked degree, and the active peristalsis as shown on the abdominal wall. Other things are confirmatory, such as the X-ray.

The question is not so much as to the diagnosis, because that must of necessity be comparatively easy, but what the nature of the condition is. We have no examples, so far as I know, in pathology of equal enlargement, with both a thickening of the wall and dilatation of the organ, except those due to some obstruction. This obstruction, according to some of the opinions I have read, is not necessarily an obstruction as the result of mechanical means. It can be due to a flap formation or a kink, and one of the suggestive things about it is that it occurs more often in the sigmoid, the large intestine—and especially the sigmoid—being more mobile in a child of this age. But it may result in some cases from some deficiency of the bowel wall, as, for instance, defective musculature, insufficient elastic connective tissue, or even faulty innervation.

There is on record one case which does not fit in with any of these. It is where the ascending and transverse colon were enlarged, but the enlargement, instead of being confined to the descending colon, gradually went down into a funnel shape and terminated about the sigmoid. This condition is hard to explain on any of the theories just mentioned, but I think the consensus of opinion in the matter of these cases is that the condition is the result of some obstruction or some deficiency of the bowel wall, which renders it necessary that the bowel shall either dilate or increase in muscular action.

DIAGNOSIS OF TUBERCULOUS JOINT DISEASE IN CHILDREN: BRAIN INJURIES AT BIRTH *

BY E. W. RYERSON, M.D.

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Chicago

WE see here (Home for Destitute Crippled Children) so many cases every year of early joint tuberculosis which have not been correctly diagnosticated, but have been treated as rheumatism, or treated as growing pains, or treated as anything but tuberculosis, that I feel the profession in general needs to be more on the watch for joint tuberculosis than it in fact is.

The very first objective sign of tuberculosis that one can demonstrate is usually a limitation of motion in the joint, due to a spasm of the muscles around the joint, and we cannot say enough and cannot hear enough about this sign. It is, of course, a reflex spasm of the muscles which nature produces in order to immobilize the diseased and painful joint. It is the most misused and misunderstood of signs. It has nothing to do with ankylosis. Motion may be free and painless through nearly all of its range, except perhaps at the extreme limit of flexion or abduction or extension or rotation. Here is a patient with hip-disease. I have not looked at this little girl for some time. This leg is perfectly normal; she has the full range of motion. Now let us look at the other leg, the left one. You can see the instinctive effort at protection which this little girl shows. This is very exaggerated, of course, and it is not as typical as some of the cases I would like to show you where the leg will go through a large range of motion, but it will not come down perfectly into the extended position. It will not hyperflex into the belly, nor rotate. The limb is painful and sensitive, so much so that we cannot approach the normal range of motion with it. The hip is carefully guarded.

* Clinic given under the auspices of the Chicago Pediatric Society, October, 1914.

When a child has beginning tuberculosis of the spine, the first symptom the parents usually notice is that the child holds the back quite stiffly, and so the mother says it cannot possibly have anything the matter with its back because it holds it so straight. She thinks the child must be all right, and cannot have anything the matter because he walks in like a little major. When you drop something on the floor, instead of stooping over like this (indicating), he will, if it be in the lower dorsal and upper lumbar region, pick it up without bending the back. This instinctive protection of the joint is the most valuable sign we can have in the diagnosis of tuberculosis of the joint, and it is one almost invariably neglected. Ask the average practitioner what the signs of tuberculosis of the spine are, and he will say kyphos, the hump, and cold abscess. We have many cases every year which never have a cold abscess. We have a good many that never develop a hump, and yet they are just as typical cases of tuberculosis of the spine as anything can be when the child is laid face down on the table. Most of the spine cases on my service have had the Albee operation done, so that I cannot show you the stiffness in the back that a child has with early Pott's disease, where there is no destruction perceptible by the X-ray. If the child is laid upon the table with face down, and the two feet are picked up with one hand and the patient is arched up in this way to hyperextend the spine, instead of a perfectly regular smooth curve, as the normal spine makes when it is hyperextended in this way, perhaps three or four vertebræ will be fixed so that there will be a flat spot in the spine. The rest of the spine, above and below, will curve normally, but at the site of disease there will be a stiff area.

While the child is being held in this way, the fingers of the other hand, pressing up and down the spine along the erector spinæ muscle, will detect a certain feeling of tension of the muscles due to spasm. They are protecting the painful spine. These two signs in the presence of a positive von Pirquet reaction, to which I attach a great deal of importance, will make it necessary to consider the average case of this sort, with a chronic history, with a usually painless development of stiffness of the back, almost certainly a case of Pott's disease. We do not need to wait for a cold abscess or a hump in the back in Pott's disease, or for flexion and deformity of the hip to make a diagnosis of hip-joint disease, and it is enormously to the advantage of the patient if we can make a diagnosis and institute treatment before

there is fixation or marked deformity or destruction. This is pre-eminently so in Pott's disease, because, with our present method of treatment by artificial ankylosis of the spine by means of a bone splint or by means of cutting through the spinous processes and the laminae and making an ankylosis after the method of Hibbs, it is possible to cure a child of tuberculosis of the spine with no deformity whatever; and not only have they no deformity, but they will not get any deformity, so far as our experience of three years is concerned. It is now three years since the first three Albee operations were done in this city by myself, and we have done a great many since, and we have learned that the deformity of Pott's disease can in most cases be corrected if we make the diagnosis early. If we wait for a hump, we cannot correct the hump in some cases, although in others we can.

Are there any other aids in the diagnosis of tuberculosis of joints? I have attached great importance to the von Pirquet test; I have seen no case of joint tuberculosis up to this time that did not give a positive von Pirquet reaction, although I have heard of such. I have seen some syphilitic joints that had been diagnosticated as tuberculous which did not give a positive von Pirquet reaction. I think the von Pirquet test is extremely reliable and valuable, and our experience shows it is almost infallible, so that I hesitate to make a diagnosis of joint tuberculosis in the absence of a von Pirquet reaction. I do not myself think it is wise or safe or advisable to give the massive doses of tuberculin for diagnostic purposes which many other men consider safe and proper. I would be unwilling to have them give such large doses to me. I think there is no possible danger in the use of the von Pirquet test, and it, of course, is of value only if it be negative. A positive von Pirquet test means nothing. The child may have a positive von Pirquet test and have no tuberculosis whatever in a suspicious joint. It may come from other foci or may exist only in small nodes. The localization of tuberculosis in joints by the injection of massive doses of tuberculin is very reliable. Undoubtedly, if we inject in the average case one and a half or two milligrammes of tuberculin we will get a positive and marked reaction in the affected joint. However, I believe that I have seen so much damage caused by such doses that I am unwilling to use it. We can make the diagnosis without it.

What help does the X-ray give us in the early diagnosis of tuberculosis? In small children it can give us absolutely no help, because we must remember that in small children the epiphysis, the head of the femur, for instance, is not shown at all in a child at an early age. The head of the femur is cartilaginous and soft, and the X-rays pass readily through it. The only thing we can see is a little centre of ossification, and it is useless to try and size up a hip-joint tuberculosis in a small child by the X-ray appearance. The entire head of the femur may be destroyed except a little osseous centre or centre of ossification that may happen to be the only part of the head of the femur that is not destroyed, and yet the X-ray will not show it. It is only in the older cases or in those cases with wide destruction that we can depend upon the X-ray picture.

Our time is rather short this morning, and I do not know that it would interest you to see X-ray pictures of tuberculous lesions. We have large numbers of them in the hospital, and I have a few here which show the typical Pott's disease and hip disease and tuberculosis of the knee, but they all are cases which are old enough to have practically complete ossified bone in the region where the lesion exists in the spine. For instance, we can readily see in many of these pictures the area of destruction. In the hip we can see in such pictures areas of destruction, but I wish to impress upon you that in a small child, in a child under four or five years of age, it may be possible to have a tuberculosis of wide extent, involving almost the entire head of the femur, without any X-ray appearance that you or I or the most skilful of X-ray interpreters can diagnosticate as tuberculosis. We read in some of our books, and in some articles that are written, of the value of the X-ray in the diagnosis of tuberculosis, and the X-ray is of great value in the diagnosis of tuberculosis, and the X-ray is of great value in the older cases, but it is of very little value in the young cases.

BRAIN INJURIES AT BIRTH

I am going to say a few words about a subject that has been interesting us enormously in our various clinics, and that is, birth injuries to the brain which apparently are very common, and which are almost never diagnosticated at an age sufficiently early for proper operative treatment to be instituted. Such cases fill our hospital clinics, and at my clinic here and at the Children's Memorial we have

sometimes six or eight spastic imbeciles or idiots a week for whom very little can be done.

Green, of Boston, has written what I consider a very important paper on this line, emphasizing the fact that nearly all of these epileptic and imbecile spastic cases are blue babies; that most of them had convulsions at the time of birth. He believes that most blue babies have an intracranial injury. It is possible in some cases to diagnosticate the location of the injury. If a child at birth be healthy and well, and nurses well, and seems like a normal child, and then fades off into a stuporous or semi-stuporous condition and refuses the breast, and gradually becomes comatose, we know that in such a case the lesion is usually a rupture of the longitudinal sinus, with a slow venous hemorrhage, which produces the symptoms. If the child is blue at birth and stays blue, and has a number of convulsions, and there are no localizing symptoms—sometimes there are and sometimes there are not—it is probably a meningeal hemorrhage.

The only early case I have operated on was through the kindness of Dr. Churchill. This child had a quadruplegia. There was complete spasticity; there was bulging on the left side. I turned down a skull flap, and there came out from between the dura and skull a mass or clot of blood half as large as a hen's egg. After the removal of this the spasticity within twenty-four hours began to improve. A little later it all disappeared, the child went on improving and made a perfect and uninterrupted recovery, and returned to its home in Virginia in a few weeks. If these cases are seen early enough the clot can be taken out.

Following the work of Farrell and Sharpe, of New York, we have done wide decompressions on five or six of the older cases, with, in a few instances, apparent benefit. It is too early to draw conclusions from our own material, but Farrell and Sharpe are convinced that much benefit may follow decompression in cases where the eyes show any signs of increase in intracerebral pressure.

The subject is one of great interest, and needs full investigation, but these cases should be diagnosticated and operated within a few weeks after birth for ideal results.

ENLARGED SPLEEN; SPLENIC ENLARGEMENT; ANTERIOR POLIOMYELITIS

BY HENRY W. CHENEY, M.D.

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CASE OF ENLARGED SPLEEN

THIS little girl is nine years old. Last spring it was noticed that the abdomen was becoming larger. She was under observation in the hospital during the summer. Since June it was found that she had more or less fever every day, her temperature rising in the afternoon to 100° and 101°. She had a distinct and uniform enlargement of the abdomen—quite general, and much more marked than at the present time. During July and August the abdomen was quite enlarged, which enlargement consisted not only of the enlarged spleen, but also an accumulation of fluid, which could be easily demonstrated by the ordinary methods. Aspiration of this fluid and an examination of it showed it to be the result of a tuberculous peritonitis. The cellular content of the fluid indicated that. An injection was done into a guinea-pig, and the animal died with the lesions of tuberculosis of the glands and bowel, so that it proved that the little girl did have a tuberculous peritonitis, causing the accumulation of fluid.

Under treatment that fluid disappeared, so that now there is practically none at all in the abdomen. All of this time, in addition to the fluid, there was the enlarged spleen, which you see outlined. She is not in the hospital now, but at home and attending school. In the spring, when we first saw her, the spleen was larger than at the present time, being on a level with the umbilicus, or even below. During the past two or three months it has lessened in size, until it is as you see it outlined. The spleen is not tender, and presents simply the usual feeling of an enlarged spleen. The liver is not enlarged. During this time the blood examination has not shown any of the changes which would be typical of a leukæmia. It has shown a simple anæmia, the hæmoglobin ranging from 40 to 50 per cent. during the height of the summer's illness, and a decrease in the red cells. I have not

her history here, but the decrease in the red cells was marked. There was no change in the white corpuscles.

Preceding her appearance in the hospital she also gave a history of passing a tapeworm. There has been no return of that condition. I think that was simply coincident with the other illness, and probably had no relation to it.

The treatment given her consisted of small doses of arsenic each day, and then, after the tuberculous peritonitis was definitely established, we began giving her small doses of tuberculin at regular intervals. While in the hospital she also had daily exposures of the abdomen to the direct rays of the sun, beginning with short intervals, and lengthening those each day, to prevent severe burning of the skin, and under that treatment the tuberculous peritonitis seemed to rapidly improve and the fluid disappeared from the abdomen.

In my own mind, the diagnosis then was a combination of a simple splenic anæmia, or von Jaksch's anæmia, and a tuberculous peritonitis. The latter was definitely diagnosed because of the result of our experimental injections. Evidently we have here a little girl who has had tuberculous peritonitis which has been cured, or at least so far cured that it will no doubt go on to a cure.

In this little girl, also, I conducted an experiment, which may be interesting to you, in the administration of urotropine, to see what effect it would have upon the urine and, perhaps, upon the tuberculous effusion. It promptly appeared in the urine, and continued there all the time of administration, and we gave her ten grains, three times a day, for a continued period of time. The second aspiration of fluid from the abdomen was examined for any trace of formaldehyde, but none was found. That, perhaps, is a point to remember in the excretion of urotropine or formalin from the body. There was no trace of formalin from the urotropine in the tuberculous effusion.

The little girl is very much better now, but still has the enlarged spleen, as before stated and as you can see. However, she is able to attend school, and I think will get quite well.

SPLENIC ENLARGEMENT

Here are two more cases of splenic enlargement occurring in the same family, in a brother and a sister. The little girl is three and a half years old, and the baby boy one and a half years of age. There

is a syphilitic history in the family. The mother has had several miscarriages. There is no doubt about the syphilitic infection of these two children. They came to the dispensary within the last month, and have been under observation only for that period of time. They were brought into the dispensary because of the enlarged abdomens and apparently sick condition generally. We have not had a chance to make as complete blood examinations or as extended histories as we would like, because of the ignorance of the mother, an Italian, who objects to almost any blood examination.

I will first show you the boy. The spleen is enlarged, as the outline shows, practically down to the crest of the ilium, and running across below the level of the umbilicus. The liver also is enlarged, one to two fingers' breadth below the border of the ribs. This youngster has some enlargement of the glands. The epitrochlear on one side is enlarged, and the cervicals slightly; the inguinals quite markedly so. This condition is probably due to the syphilitic infection. The blood picture in this case gives a very marked increase in the leucocytes. There have been three counts of the white cells. The first one, a month ago, gave 101,000; a few days later, 76,000; and a count made a week ago, 140,000. No count has been made of the red cells in this case. A differential count showed that of the white cells, 50 per cent. were lymphocytes; large mononuclears, 15 per cent.; polymorphonuclears, 15 per cent., and the others scattered among the other cells, eosinophiles, basophiles, and neutrophiles.

The sister is three and one-half years old, and the spleen in her case is equally large, perhaps extending farther down into the iliac fossa here (indicating) and farther over toward the umbilicus. The liver also is rather more enlarged, as outlined here. With the sister there are also the lesions of a hydrocephalus, as you will see. The flat nose observed is due to the syphilis. Only one blood count has been made in this case, which showed red cells, 3,000,000; leucocytes, 32,800. The lymphocytes showed 41 per cent.; large mononuclears, 10 per cent.; polymorphonuclears, 35 per cent. The suggestion from the laboratory man relative to the blood is that the blood picture probably shows a splenomyelogenous leukæmia. In my own mind it is a little doubtful as to just the classification of these two conditions. They are younger than any reported cases of leukæmia that I can find, though it is quite possible that they are leukæmic

cases. It is quite possible, also, that the syphilitic infection may account for the whole picture. Cases have been reported of this kind which showed the blood changes resembling leukæmia. In the little girl with the large head the syphilitic infection is probably responsible for the hydrocephalus. The glands are also enlarged in the girl.

These children have not been with us long enough or regularly enough to institute any definite treatment. I simply present them as probable leukæmic cases. The laboratory man who made the blood count thinks it is a typical picture, but still there is a possibility that the hereditary syphilis may cause all of these changes which they show.

ANTERIOR POLIOMYELITIS

During the summer there has seemed to be, from various reports we get, somewhat of an increase in the number of cases of acute poliomyelitis in the city, and we find that fact reflected in the clinic here because we have had a larger number than usual coming to see us. During the three months just passed we have had six cases or more of this disease. That number is much larger than the average. We do not average more than ten cases a year. This morning I have two cases to show you.

This youngster is one and a half years old. He was taken sick suddenly two months ago—about the middle of August. The mother said he suddenly developed fever and constipation, and slept a little more than usual. This lasted a few days. Two days after onset of the fever the mother noticed that the right arm could not be used, which condition has persisted ever since. As you will notice, the right arm hangs at the side, without any motion at all, whereas motion in the other one is free. Paralysis of the right arm was not complete, inasmuch as there was some motion in the fingers at all times, and that has been improving somewhat. He can use the fingers and the hand muscles, but none of the shoulder group, the arm or forearm. He can grasp objects fairly well.

Just about the same time, or within a week, this other child came to the clinic, presenting almost the same history, only not sick quite so long. He came to the clinic a few days after the onset with the history of acute fever, lasting two or three days, and then paralysis of the left arm. It is rather unusual to get two cases so close together

and so much alike. In this case there is not quite so much motion as in the first one, but still a few of the muscles of the hand and fingers will work.

In some of the other cases we have had there has been a more extensive paralysis, monoplegia, or diplegia, both legs being involved in some cases, and the arm and leg in others.

Regarding treatment, we have prescribed urotropine, more because we wanted to prescribe something than from any real belief in the drug. Urotropine had considerable vogue some time ago, but more recent experiments have questioned its value—whether it has any influence on the organism in this condition or not. We advised the caretakers or parents of the children to do nothing at all in the way of massage or passive motion in the very beginning. We suggested waiting a month or perhaps six weeks before beginning the active treatment in the way of massage and passive motion. We have not used electricity at all. Refraining from active treatment at first is wise, I think, particularly in those where the lower extremities are involved. The use of these paralyzed muscles too early is, I think, inclined to increase the later deformity. The muscles are liable to be stretched if used too soon. So we advised both of these cases that after a month they can begin encouraging the little ones to use the arm; massage the muscles thoroughly, and try in every way to get motion back. The first case shows some slight improvement. We can usually promise the mothers that considerable improvement will take place. It is remarkable, as most of you know, how much good will result in some of these cases that seem to be hopelessly paralyzed in the beginning. I had a little girl who was paralyzed in both legs two years ago, and under this line of treatment and steady, faithful care by the mother, and massaging of the muscles, with encouragement to walk and, later, consultation with an orthopædic surgeon, who advised the wearing of braces for the last year, this little girl is now able to walk around quite well, and goes without any brace. There is a little extraluxation of the knee and a little backward bending of the knee, but she gets around without any help at all, and plays with some of the other children. In the majority of these cases we can promise the parents that improvement to a marked degree will take place, so that I think with these patients the outlook is very encouraging. Good motion in the arm will come in time, and surely in the hands—perhaps enough

to make the hands very useful members. Improvement often takes place after the lapse of a year or even two years. We need not be discouraged, and can keep on encouraging the patients even so long as a year or a year and a half.

In this third case the paralysis occurred five years ago, and was complete in both legs. Since then he has received all kinds of treatment, and has improved somewhat. Dr. Porter has operated on the legs once or twice, and he can walk around now all right without any trouble. He still has a brace on one leg.

This shows the encouraging results of good treatment. However, the hope of the future will lie in preventive vaccination or inoculation for these cases, because when the diagnosis is made and we are ready for treatment the damage is all done. I hope, as you do, that before many years we will have some sort of preventive treatment that we can give to all children, thus making them immune to the infection.

GYROSPASM (SPASMUS NUTANS); TUBERCULAR MENINGITIS VERSUS TRAUMATIC CEREBRAL INJURY; PROBABLE SARCOMA OF THE RIGHT LUNG

BY JULIUS H. HESS, M.D.

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GYROSPASM (SPASMUS NUTANS)

I FIRST saw this anæmic baby about two weeks ago, at which time it presented considerable evidence of advanced rhachitis. The history given by the mother was that it was breast-fed for the first four months. About the fourth month it was able to sit up, when the lateral turning of the head was first noticed, which has increased steadily since that time. Also, when the child focused its attention on objects, there was nystagmus. When asleep this lateral rotation of the head disappears. The condition here is one of rotary spasm in contradistinction to the nodding spasm, a similar but less frequent condition. As is usual, rhachitis is an associated condition. The combination of head movements and nystagmus suggests that the nuclei of the spinal accessory and upper spinal nerves are in close relation to the oculomotor nerves. The head, trunk, and extremities are not involved.

We placed the baby upon a mixed diet of vegetable soup, orange-juice, and a little vegetable, and also gave cod-liver oil and phosphorus. The mother believes the child's condition has already, in the course of two weeks, shown some signs of improvement. The gyrospasm usually disappears by the end of the second year, even if untreated, possibly at the same time that the rickets disappears. At the time of correction of proof, four months later, the gyrospasm had entirely ceased, while the nystagmus, though still present, is greatly decreased.

TUBERCULAR MENINGITIS VERSUS TRAUMATIC CEREBRAL INJURY

This second case is open for diagnosis. This infant entered the hospital on October 13, 1914. Two and a half weeks before admission the child fell from its baby cart, landing on its head. Two days later she started to vomit, and was very listless and drowsy. She continued

in stuporous condition for a week, had several convulsions, and developed an internal strabismus. There were no chills, fever, or headache. The stuporous condition continued, however. The child has lost four pounds in weight. Stools normal in number, consistency, and color, but contain some mucus, but no blood. The child is the youngest of four. Its birth was normal. Its first teeth erupted at fourteen months. It does not walk or talk, and is seventeen months old, and shows profound evidence of rhachitis. The child has been bottle-fed, but has had no food disturbance to date. The child was never put to the breast, because the mother had an active tuberculosis, which has been aggravated by this pregnancy. At present she is in an advanced stage of tuberculosis. This infant had pneumonia at the age of one month. Other than for the mother's pulmonary history the family history is negative.

Physical findings at the time of entrance were as follows: The appearance of the child was that of an apathetic, drowsy infant. The eyes were sunken, and there was an internal strabismus present. The skin was dry and inelastic. The cervical glands were palpable. The large fontanelle was nearly closed. The strabismus was more marked in the right eye. The child could see objects before the eyes, but did not follow them. Ear examination was negative; no mastoid tenderness. There was no rigidity or tenderness of the neck. The thorax was negative. The abdomen was negative except for a slightly enlarged spleen. Babinski's sign was present and quite marked on both sides. Tache cérébrale was very markedly positive.

On entrance to the hospital, October 14, 1914, a spinal puncture was made, after which the child seemed more listless, but remained about the same for three days, when another puncture was made, with no untoward effect. On the fourth day after the entrance the child seemed better. The rigidity had almost gone. There was only very slight internal strabismus of the right eye. This condition lasted for two or three days. The child gained in weight and seemed to be improving generally, when he started to vomit again and the general condition became worse. The eye symptoms were somewhat more marked, and the whole condition seemed to be one of retrogression. Since October 26, four days following the second setback, he has not vomited. Temperature normal, reflexes normal, and the strabismus has disappeared and he seems quite well.

Laboratory Findings.—Urine negative on several occasions. Tuberculin reactions, both cutaneous and intradermal, negative. Hæmoglobin, 85 per cent.; red cells, 4,000,000 plus; white cells, 12,600. This blood count is quite normal for a child of seventeen months.

Spinal Fluid Examination.—First count, October 14: 35 cells to the cubic millimetre; 100 per cent. lymphocytes. Pressure was not markedly increased. No organisms. Noguchi negative. Ross-Jones negative. Two days following, the cells were 28 to the cubic millimetre; 90 per cent. lymphocytes. Globulin tests still negative. On the 26th (yesterday) the lymphocytes were again 100 per cent.; 37 cells to the cubic millimetre; globulin tests both positive; no organisms were found. Lange negative; Wassermann negative.

Conclusions.—With a history of active maternal tuberculosis, in the presence of the other positive findings, even in the absence of positive tuberculin tests, naturally these findings led to a diagnosis of tubercular meningitis. The spinal fluid findings were at the time considered as early positive findings. We have rather reluctantly changed our opinion from one of beginning meningeal tuberculosis to possibly some cerebral injury due to the fall. In the presence of the history of the mother, one must still be suspicious of these spinal fluid findings, as indicating a latent or at least a subacute meningeal affair.

At the time of correction of this proof, four months later, the infant is, to all appearances, in perfect health, while his mother is still in the municipal tuberculosis sanatorium.

PROBABLE SARCOMA OF THE RIGHT LUNG

This little girl of thirteen years gives a personal history of a full-term, normal child. Breast-fed for six months. Past history also negative, except for the fact that she was always a weak child, and quite frequently suffered from headaches. Entered the hospital April 8, 1914. The trouble was first noted two weeks before this time, starting with a mild cough and general malaise. This cough gradually became worse—it was not productive; most marked at night and in the early morning. No chills, no night-sweats. She lost about two pounds in weight the week preceding coming to hospital. No urinary symptoms; no fever. Blood examination at the time of entrance to hospital (the first of four) showed 10,000 white cells; lowest, 9400. Average of 56 to 74 neutrophils, ranging within the normal.

No abnormal cells. It can be readily seen that the child is somewhat anæmic, notwithstanding the fact that she has red lips, which, on further examination, you will find to be cyanotic.

Now when the chest is exposed you will notice a relative fulness on the right side of her neck, which extends down to the clavicle, so that the supraclavicular space on the right side is obliterated, and the same can be said of the infraclavicular space on the right side. You will also notice that the anterior axillary border on the right side is lower than on the left. The veins are also somewhat larger and more prominent than on the left side. In other words, the entire right chest bulges. The right shoulder is also very much higher than the left. There is a very marked scoliosis, with the curve to the left side. On percussion the upper part of the right chest is absolutely flat. Vocal fremitus is entirely absent over the upper part of the right lung posteriorly. The same is true anteriorly. On auscultation you hear nothing but marked bronchial breathing—no râles.

Paracentesis was done on this girl repeatedly, both before and behind, with the idea that possibly she had some form of encysted pus or other fluid in her right chest. However, nothing was obtained except blood, which was also negative upon every examination made. Two skiagrams were made, the first of which showed a very marked scoliosis, the heart being pushed quite a distance to the left, so that there was about one-quarter of an inch of lung tissue between the left border of the sternum and the heart. The nipple is pushed about two centimetres to the left of the mid-sternum line on the left side. You see a very small area of lung tissue pushed up here (indicating), just below and at the outer edge of the clavicle, and a small area of lung tissue below at the lower outer border (indicating). The mass assumes almost a perfect contour, and this is what led us to believe that possibly we had to do with a cyst, possibly an echinococcus cyst, or, on the other hand, an encapsulated new-growth. This second picture, taken somewhat later, shows the entire process on the increase. The heart is pushed somewhat farther over; there is a more marked scoliosis and less lung tissue, on the whole. The child's general appearance is not quite so good. To our minds, the diagnosis rests between a sarcoma of the lung, as the most possible new-growth, and an echinococcus cyst. We have no reason to believe the latter present, because the punctures were all negative. Our conclusions, therefore, lead us to assume that this is a new-growth.

A CASE OF CANCER OF THE PANCREAS IN A NINE-YEAR-OLD BOY, WITH NOTES ON OTHER REPORTED CASES OF CANCER IN CHILDREN

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ON March 10, 1913, a white male child, H. M., nine years of age, was admitted to the Clearfield Hospital, complaining of dull pain referred from the iliac crests to the pubic region. His family and social histories were negative. He had always been unusually healthy and robust, having escaped the usual diseases of childhood, and his life had been spent largely in the country. Four months previously a playmate had kicked him in the upper left abdomen; the pain resulting was transitory and mild. One month later the lower abdominal pain began and a mass was noticed in the upper left abdomen. This mass was never very prominent, but was noticed to fluctuate in size. Marked constipation appeared with the other symptoms. Aside from constipation, there were no other intestinal symptoms excepting an absolute loss of appetite during the two weeks previous to his admission to the hospital. There were no symptoms referable to the genito-urinary system; no nausea, vomiting, fever, chills, sweat, jaundice, "heart-burn," "water-brash," nor pain in the upper abdomen following the injury. No pain was referred to the back or shoulders. The stools were always normal in appearance. The patient thought he had lost some weight and he felt weak. There were no chest symptoms.

Physical examination showed a well-nourished, muscular boy, with good color and eyes reacting normally. His tongue had a white coating. The heart and lungs were negative; the abdominal muscles well developed. The lower pole of the spleen during deep inspiration was palpable below the left costal margin. Internal to the spleen an irregular mass, feeling to be the size of the child's fist, descended

to the level of the umbilicus on deep inspiration; on expiration its lower border was two and one-half centimetres above the umbilicus. Its upper border seemed to approach the posterior abdomen and was not sharply defined. The right border of the mass was not well defined, but did not seem to extend farther to the right than the midline. The left border was well defined, reaching to a horizontal line dropped from the tip of the left ninth costal cartilage. Deep palpation elicited tenderness of the mass. There was no tenderness in the back. Pressure in the left loin threw the mass forward, but pressure over the mass anteriorly made no impression on the hand in the loin. The extremities and the glandular system, also the urine examination, were negative.

On March 11, 1913, an upper left rectus incision was made. The left kidney was found to be normal in size and position. A tumor was found to be of the tail of the pancreas, and the entire pancreas was slightly enlarged, hard, and irregular. The tumor-like tail was nodular in addition (some of the nodules being the size of an ordinary marble). Along the upper and lower borders of this portion of the pancreas a few reddish lymph-nodes were noticed. The pancreas was freely movable. The appendix was removed and found to be normal. The liver, gall-bladder, common and hepatic ducts, stomach, colon, and intestines appeared normal. The spleen was slightly enlarged, but otherwise of normal appearance. The transverse colon was pulled upward and the peritoneum overlying the tail region of the pancreas was incised. Next a knife was inserted on the greatly enlarged portion of the pancreas for a distance of 1.5 Cm. This was withdrawn and a closed hæmostat was inserted at this place and withdrawn open. A small amount of serous fluid and a bit of white, cheesy material exuded. To this there was no odor. The opening in the pancreas was packed with selvedge gauze, and a cigarette drain placed in this region. This procedure was followed with the feeling that, though the pancreas was of a malignant appearance, the child was entitled to the chance it would afford for recovery if the condition was inflammatory. The wound was closed to the drainage. The operation did not consume much time, and the patient was returned to bed in good condition.

Following operation the patient continued to refuse nourishment by mouth. On the fifth day the drainage was removed. This was

followed by a free discharge of irritating fluid (producing the excoriation characteristic in pancreatic fistulas). The patient gathered no strength; on the twelfth day after operation his abdomen became distended; two days later he died.

An incisional autopsy was the only available procedure, and this showed the pancreas to be about twice as large as at the time of operation and of the same appearance. Portions of it were removed for examination. General purulent peritonitis was present.

The tissue removed was pale and surrounded by a thick, fibrous-like capsule, varying from 0.05 to 0.3 Cm. in thickness. This surrounded cheesy, yellow and white, gelatinous-appearing areas which went to make up lobules, in turn enveloped by whorls of fibrous-like tissue. There were several cysts about 0.5 Cm. in diameter present which were found to contain serous fluid.

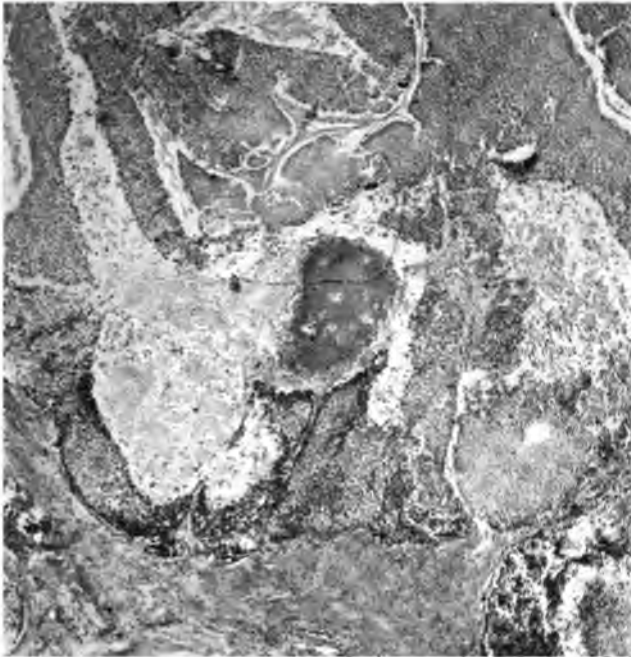
Microscopic examination of this tissue stained with hæmatoxylin and eosin showed a fibrous-tissue network that was quite thick in areas (Figs. 1 and 2). This was occupied by islands of endothelial-like cells, closely packed; some of these cells showed mitotic figures, and some of the islands of cells were entirely necrotic; others showed central necrosis with signs of phagocytic action. Some were isolated, others clumped and separated by thin, fibrous-tissue projections. After careful study the condition was named medullary cancer of the pancreas. (See photomicrographs of Section S 3298, Josephine M. Ayer, Clinical Laboratory, Pennsylvania Hospital.)

Kühn,¹ in 1887, reported a case of primary cancer of the pancreas in a two-year-old girl. On physical examination the child showed cedema of the legs and an enlarged liver. Pneumonia intervened and terminated in death. At autopsy the pancreas was found to be changed into a reddish tumor hardly the size of the normal gland. It had hard, white nodules, and similar nodules were present in the lungs in the form of metastases.

Microscopic examination showed connective-tissue prolongations, lined by cylindric and other formed cells. A diagnosis of cylindric-cell adenocarcinoma of the pancreas was made.

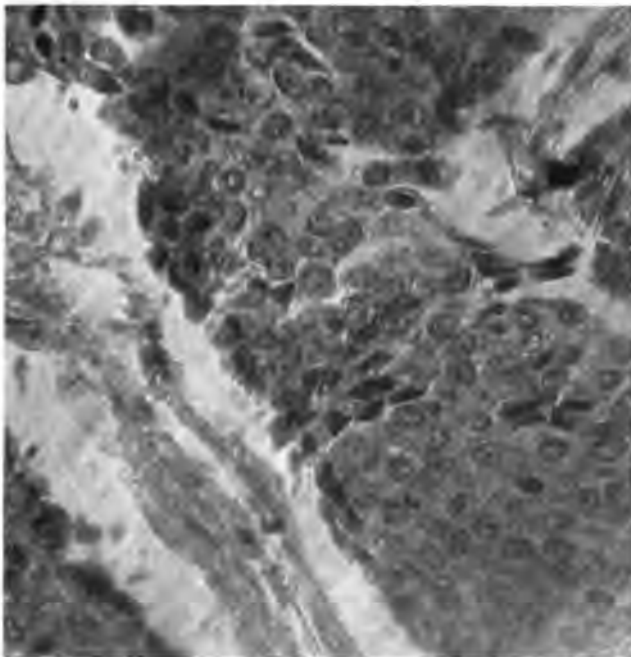
Simon² reports a case of cancer in a thirteen-year-old boy who came to him April 16th with a history of being ill all winter with severe diarrhoea and loss of appetite, weight, and strength. Eight weeks before admission jaundice appeared, followed by obstinate con-

Fig. 1.



Cancer of the pancreas. (Microscopic slide, low power.)

Fig. 2.



Cancer of the pancreas. (Microscopic slide, high power.)

stipation. Eight days before admission he began to be bothered with vomiting after meals, heaviness in the stomach, and extreme weakness.

On physical examination the boy was found to be of medium size, jaundiced and cachectic, with edema of the extremities. The veins of the abdomen were dilated, and liver enlarged, extending in the axillary line 4 Cm. below the costal arch. Nodules were palpable beneath the belly-wall, apparently attached to the liver. There was no sign of lymphatic involvement. The urine showed the presence of bile. On May 2nd of the same year the child died. Autopsy showed a prominent, smooth, shiny, olive-green liver, dotted with many whitish nodules the size of a lentil or cherry. The gall-bladder was distended with bile. The abdomen contained 400 Cc. of slightly cloudy fluid mixed with flakes of fibrin. The spleen was hard, its capsule tense. There were adhesions between the colon and liver, while the root of the mesentery showed a tumor the size of two fists. On loosening the stomach at its lesser curvature the mass was encountered, and on opening the duodenum at the level of the head of the pancreas its wall was found to be included in the tumor tissue. Five centimetres beyond the pylorus its mucosa stopped, and the carcinomatous wall was found to extend to the beginning of the jejunum. The common duct opening was in the midst of the mass and patulous, though it had a stricture caused by the tumor. All of the pancreas was occupied by the mass excepting a small portion of the tail.

A diagnosis of cancer of the duodenal portion of the pancreas, with metastasis to the liver and kidneys, dilatation of the biliary ducts, inflammatory hyperplasia of the spleen, chronic follicular enteritis, hydrops, icterus, and ascites, was made. The question arose as to whether the tumor was primary in the duodenum or pancreas. Simon concluded that the growth probably originated in the pancreas, as the microscopic sections showed no cylindrical cells such as he considered one should see in duodenal cancer.

The three cases permit of limited comparison and no valuable conclusions.

Kühn and Simon put different constructions on the presence of the cylindric cells. Simon was not sure that the carcinoma was primary in the pancreas. Kühn was positive in his claims. In the case reported a complete autopsy was impossible; however, there was no

evidence suggesting that the cancer was not primary in the pancreas, nor was there evidence of cancer elsewhere. Loss of appetite, weight, and strength, and obstinate constipation were symptoms common to this and to Simon's case. Edema of the legs and enlarged liver were common to the cases of Kühn and Simon, but in these metastasis had taken place.

DaCosta,³ in 1858, quoted Rokitansky as having mentioned an instance of the pancreas being found scirrhus at birth. Todd⁴ reported the case of a female, fourteen years old, who was ill some months with a tense swelling in the epigastric region, extending to the right hypochondrium; it was tapped, and greenish fluid escaped. There was a pain in the epigastrium, at times very acute, that was increased on pressure. The skin was deep orange colored. Great debility and emaciation accompanied. Ascites and anasarca were present, and there were dyspeptic symptoms. For some time abdominal pain and convulsions were prominent symptoms. The development of the disease followed a fever with relapses. The post-mortem appearance of the pancreas showed the head and glands around it converted into a hard, solid mass; its duct was obliterated. The liver appeared healthy; the cystic duct was dilated, but at its juncture with the hepatic duct it was impervious; the remaining portion was natural.

These two cases are not supported by microscopic findings. So far as we find, the cases of Kühn and Simon and the one we have recorded are the only cases of pancreatic cancer reported in children that have seemed beyond a reasonable doubt to have been primary in this organ.

Castle⁵ reports 42 cases of carcinoma of the liver in childhood, including his own.

Peiper⁶ reports what he terms a malignant embryonal adenoma in a seven-month-old infant who died three days after exploratory operation. Autopsy showed a tumor of the left lobe of the liver. Microscopic examination showed carcinoma of the left lobe of the liver. There was no evidence of cirrhosis. In places the tumor cells were in nests, surrounded by connective tissue. The cells were of three kinds: still undifferentiated embryonal structures; liver-cells; duct-lining cells. The latter he considered proof of embryonal origin.

According to Peiper, liver cancer in infants and children seems to

CASTLE'S TABLE OF PRIMARY CARCINOMA OF THE LIVER IN CHILDHOOD

Case	Age	Diagnosis	Author	Publication
1	18 mos. (F.)	Medullary cancer of liver.	OLIVER.	Chin. d. Hop. d. Ent., 1841, iv, 333.
2	8 mos. (M.)	Scirrhus cancer of liver.	GROSS.	Am. Med. Chir. Rev., 1857, i, 414.
3	8 mos. (M.)	Medullary cancer of liver.	CH. WEST.	Kinderkrankh., 1857, i, 414.
4	12 mos. (F.)	Medullary cancer of liver.	W. ROBERTS.	Lancet, London, 1867, i, 77.
5	17 mos. (M.)	Carcinoma of the liver.	APPLECK.	Trans. Edinb. Obs. Soc., iv.
6	17 mos. (M.)	Liver cancer; cancer of peritoneum.	LICHTENSTEIN.	Ziemssen, Spec. Path. u. Therap., viii, 321.
7	1 day (F.)	Liver cancer.	KUFNER.	Jahrb. f. Kinderh., N. F., 1883, xx.
8	3 day (F.)	Medullary cancer of liver.	E. NOEGGERATH.	Deutsche Klin., 1884, vi, 496.
9	13 day (F.)	Alveolar cancer of liver.	H. WIDENHOFER-WIDL.	Jahrb. f. Kinderh., 1850, ii, 191.
10	13 yrs. (M.)	Medullary cancer of liver.	PEPPER.	Zentralbl. f. Kinderh., 1877, ii, 73.
11	2 mos. (F.)	Cancer of the liver.	S. GAZ.	Gerhardt's Handb. d. Kinderkrankh., iv, 830.
12	4 yrs. (F.)	Cancer of the liver.	HENCKEN.	St. Barth. Hosp. Rep., vii, Zit. n. Reuber's Diss.
13	14 yrs. (M.)	Cystic medullary cancer of the liver.	DROCHAKOFF.	Ref. Jahrb. f. Kinderh., 1885, xliii, 468.
14	11 yrs. (M.)	Cancer of the liver.	BONOME.	La France Méd., 1885, 809.
15	20 mos. (F.)	Adenocarcinoma of liver.	ST. JOSEPH KIDNESHPTAL.	Zit. bei Burt, 97.
16	6 mos. (F.)	Atypical liver-celled adenoma.	BOEN.	Arch. f. Kinderh., 1886, vii, 138.
17	6 mos. (F.)	Cancer of the liver.	A. KOTTMAN.	Langenbuch's Chir. der Leber u. Gallenblase, ii, 58.
18	8 yrs. (F.)	Primary carcinoma of liver.	H. WULF.	Cor. Bl. d. Schweiz. Ärzte, 1872, No. 21, 439.
19	12 yrs. (M.)	Primary adenocarcinoma of the liver.	BIRCH-HIRSCHFELD.	Gerhardt's Handb. d. Kinderkrankh., 1879, iv, 827.
20	12 yrs. (M.)	Primary adenoma of liver with carcinoma change.	ENGELHARDT.	Ibid., 828.
21	14 yrs. (F.)	Primary carcinoma of liver.	ACKLAND AND DUDGON.	Lancet, London, 1880, i, 405.
22	14 yrs. (F.)	Primary spheroidal-celled carcinoma of the liver.	SCHLENGER.	München, med. Wochenschr., 1900, xlviii, 631.
23	15 yrs. (M.)	Primary carcinoma of liver.	GRAVITZ.	Jahrb. f. Kinderh., 1902, ii, 1310.
24	4 yrs. (F.)	Primary carcinoma of liver.	ST. SMITH BURT.	Lancet, London, 1902, ii, 300.
25	10 yrs. (M.)	Primary adenocarcinoma of the liver.	MATTHELO.	Deutsche med. Wochenschr., 1903, viii, 96.
26	12 yrs. (M.)	Primary adenocarcinoma of the liver.	PLANT.	Gas. d. Osp., 1905, ii, Jan.
27	9 yrs. (M.)	Primary adenocarcinoma of the liver.	LUBASCH AND PHILIP.	Arch. f. Kinderh., 1906, xliii, 250.
28	14 mos. (M.)	Primary adenocarcinoma of the liver.	ST. SMITH BURT.	Zisch. f. Krebsforsch., 1907, v, 361.
29	7 yrs. (F.)	Primary adenocarcinoma of the liver.	MILNE.	Post-Graduate, 1903, xviii, 991.
30	12 yrs. (M.)	Primary adenocarcinoma of the liver.	KASNER.	Jour. Path. and Bacteriol., 1909, xiii, 348.
31	6 mos. (M.)	Adenocarcinoma of liver; cirrhosis.	A. PRUET.	Arch. Int. Méd., 1911, viii, 238.
32	11 yrs. (F.)	Carcinoma solidum of liver.	LA PAGE.	Ibid.
33	8 yrs. (M.)	Primary carcinoma of liver.	YAMAGITA.	Jahrb. f. Kinderh., 1912, lxxv, 690.
34	9 mos. (F.)	Primary carcinoma of liver.	PRENIT.	Proc. Roy. Soc. Med., 1912, vi, 45.
35	6 yrs. (M.)	Teratoid adenocarcinoma of the liver.	NAAGAWA AND NAKAMURA.	Yamaguchi, 1911, 991.
36	1 yr. (F.)	Primary adenocarcinoma of the liver.		Arch. f. Klin. Chir., 1913, 1811.
37	7 mos. (F.)	Primary adenocarcinoma of the liver.		Jikkenkei, 1911, No. 128; Zisch. f. Kinderh., 1911, i, 631.
38	17 mos. (F.)	Primary parenchymatous adenocarcinoma of liver.	MIRI AND URAMI.	Ibid., 1910, No. 119.
39	1 yr. (F.)	Similar to Case 38.	MIRI AND SATO.	Ibid., 1912, No. 142; Ibid., 1913.
40	5½ yrs. (F.)	Primary parenchymatous adenocarcinoma of liver.	FUSSELL AND KELL.	Trans. Am. Ass. Phys., 1895, x, 108.
41	16 yrs. (F.)	Primary trabeculo-alveolar carcinoma of the liver with cirrhosis.		
42	10 mos. (M.)	Primary adenocarcinoma of the liver.		

be more common, possibly for the reason that cancer of this type is of embryonal character.

Dibbelt, on "Hyperplasia, Adenoma and Primary Cancer of the Liver," described a primary liver cancer in a ten-year-old girl, similar to Peiper's case.

Wagner, in eight-day and two-month-old infants, found in the round ligaments nodules that were liver tissue.

In four hundred autopsies Birch-Hirschfeld⁷ twice found single or multiple round knots, no bigger than peas, separated from the liver substance by capsules. On microscopic examination these were found to be liver-cells. "A tumor-like new formation was in the liver."

Weber reported a case of primary cancer of the liver in an eleven-month-old child. It came from the right lobe and also filled the portal vein. The microscopic diagnosis was adenocarcinoma arising from the liver-cells. The case was similar to Peiper's.

Bennett,⁸ in 1849, mentioned a thirteen-year-old boy and a fourteen-year-old girl in whom he suspected cancer, but his evidence was insufficient.

Billroth,⁹ in 1887, showed that out of 3385 cases of cancer of the uterus collected by Lever, Kuvisch, Chiari, Scanzoni, and others there was one aged seventeen (Glatter) and one aged nineteen (Beigel).

Birkett mentioned a case of cancer in the mammary region in an eight-year-old girl. This is looked upon as a sarcoma by Billroth and others.

The cases of Carmichael and Everard Home, who are said to have observed bilateral cancer of the breast in the twelfth and fifteenth years, were cited by Gross without reference.

Battle and Maybury¹⁰ recently reported an epithelioma of the nipple in an eleven-year-old girl.

Butzengeiger¹¹ and Müller¹² respectively reported primary cancer of the appendix in girls seventeen and thirteen years of age.

MacCarthy and McGrath¹³ reported from the Mayo Clinic four cases of carcinoma of the appendix in children.

Von Franque¹⁴ reported a case of ovarian cancer in a sixteen-year-old patient. His description, however, does not satisfy one as to whether the growth was carcinoma or sarcoma.

Sakaguchi,¹⁵ among twenty-three specimens of cancer of the

testicles, found two in children two and one-half and five years of age. The disease ran a rapid course in both cases.

Gleason ¹⁶ is responsible for the statement that malignancy of the prostate is observed from earliest childhood until old age.

Quite recently Dr. Harry Deaver told one of the writers of a child, fifteen years of age, on whom he had operated for cancer of the transverse colon at the Mary J. Drexel Home, Philadelphia.

Bryan ¹⁷ reported a breast cancer in a boy fifteen years of age. This would seem to have been a malignant degeneration of an adenofibroma. Bryan also mentions the case of Blodgett,¹⁸ who removed a cancer from the breast of a twelve-year-old boy.

CONCLUSIONS

In going over these cases we find 63 that seem to be authentic beyond a reasonable doubt. These were divided as follows:

Organ	Cancer	Number of cases	Under 16 years of age	Percentage of total
Liver	Yes	45	Yes	71.4
Appendix	Yes	6	Yes	09.5
Breast	Yes	5	Yes	07.9
Pancreas	Yes	3	Yes	04.7
Testis	Yes	2	Yes	03.1
Bowel	Yes	2*	Yes	03.1

*One of these two is Simon's case, in which he concluded the cancer had extended from the pancreas to the duodenum.

Of the total number of cancer cases, 45, or 71.4 per cent., were of the liver and 19 were of children under two years of age. Furthermore, some of the infants had cancer at birth. These facts incline us to agree with Peiper's view that liver cancer in children is of embryonal character. He based his opinion on the finding of duct-lining cells in cancer of a seven-month-old infant.

Symptoms probably common to cancer of the pancreas in children would seem to be loss of appetite, weight, and strength, and obstinate constipation.

None of the cases reported above have been accompanied by laboratory findings (sections excepted). In such cases as are reported above, a virgin field is offered to those studying the etiology of cancer and to those who would find an accurate test for it.

In some of these cases we find exploratory operation has shortened life. This, we believe, is due to a quick and decided lowering of

resistance occasioned by the rapid progress of the disease. Therefore in exploring children abdominally on account of tumors a grave prognosis should be given.

We can no longer adhere to the dogmatic statements of many that cancer does not occur in the young. In considering tumors, especially abdominal ones, in children, consideration must be given to cancer as a possibility. However, after an extensive search of literature on cancer the cases cited are the only ones we find recorded.

In this paper the words "carcinoma" and "cancer" are used to denote the condition, carcinoma.

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A CASE OF EPIPHYSITIS

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THE patient, Richard B——, was a fair-skinned, blue-eyed boy of twenty-two months of age, being the first-born in the family. Both parents were free of any adverse history. The child was fairly robust, though subject to rather sharp attacks of acute bronchitis, a recent attack having been complicated with tonsillitis and otitis media, the ear discharge continuing.

The first symptom noticed was an unusual thirst coming on soon after midnight, the child calling frequently for milk and not being satisfied with water. In the morning the child was found restless and irritable, lying on his back with his left thigh completely flexed and slightly rotated laterally; moderate elevation of pulse and temperature. Attempts to extend thigh were resisted with cries of evident distress. Palpation revealed nothing. A tentative diagnosis of acute tubercular coxitis was hazarded.

In the next few days the little patient developed a temperature characteristic of acute purulent infections, the mercury rising to 104° to 105° in the evening and falling to 99° to 100° in the morning. Local consultants, acquainted with the family, were called in; they suggested the possibility of acute infective rheumatoid arthritis, there being a strong maternal predisposition to rheumatoid manifestations. All were now agreed on the desirability of expert opinion, and a pædiatrist from Boston was called. He made an extensive examination, even to exclusion of meningitis by drawing fluid from the spinal canal, and decided the case was either tubercular coxitis or infective epiphysitis. The symptoms at this time consisted of the oscillating temperature previously mentioned; a rapid, thin pulse, showing less decided remissions than the temperature; complete flexion of the thigh, with slight abduction and slight lateral rotation; a scarcely discernible increase of tension along the antero-inferior portion of the ileofemoral ligament; a voluntary fixation of

the hip-joint, apparently for the relative comfort afforded; a tendency to maintain a moderate lumbar scoliosis with the convexity toward the affected side; no definite swelling or localized area of tenderness.

The specialist advised the immediate application of the Bradford frame, continued careful observation, and expectant treatment; from which it will be seen that in his diagnosis he leaned in favor of acute tuberculosis, though he did not find that temperature curve reassuring.

The continued pyrexia of infection for the next few days made operative interference seem indicated; but admittance to any hospital was barred, owing to the adjoining tenement having been placarded for scarlatina. The use of an operating room in the local hospital was finally secured. Incision was made at the "point of election," posterolateral and inferior to the great trochanter. No pus was found, and, as there appeared no swelling of the capsule, the joint was not opened (this conservatism proved later to have been a discretionary error, presumably). The incision was closed, and the patient was removed to a tent and later taken home. A rapid and inexplicable amelioration of symptoms ensued, and for forty-eight hours the little fellow seemed to be on the mend. Then the pyrexia of infection returned and the illness became worse than before. Finally, after several days, the urgency of the case plus personal appeals overcame red tape, and the child was admitted to a hospital in Boston and came under the care of a leading city surgeon.

On the morning of the second operation the child was carried on his frame ten miles by train and two miles by cab. He was bright and cheerful and made several remarks, objecting particularly to any cessation of the train's motion. His temperature that morning was 104° F.; pulse, 150. The left hip and upper thigh had become somewhat swollen anteriorly and mesially. The condition of the joint at that time is poorly shown in X-ray picture No. 1, taken just previous to the operation. A vertical incision was made on the anterolateral aspect of the thigh, extending downward 2½ inches from the junction of the inferolateral border of the sartorius with the line of the groin. About 50 Cc. of purulent material escaped. Examination disclosed destruction of the capsule on its antero-inferior aspect, with erosion of the head of the femur and some involvement of the ischiopubic portion of the acetabulum. The joint cavity was repeatedly flushed with warm saline, then drained with fenestrated

rubber tubing passing through the first and second incisions. Patient replaced on Bradford frame. Ether recovery prompt. Temperature fell to 101° that evening, and to normal on the fourth day. Removed from hospital to home on the eighth day. Use of wicks discontinued on the tenth day. Wounds entirely healed on the eighteenth day, after daily dressings with saline flushings and sterile cheesecloth applications.

For the next ten weeks the child was kept out of doors, on a swing cot by day and in a tent at night. All this time he was strapped to a Bradford frame, with pulley and weight extension, interrupted solely by the regular periods of massage and passive exercise. In August he was fitted with a Thomas extension splint, and was soon hobbling around. As his strength returned he was daily permitted to attempt walking a few minutes without the splint, and in about three months discarded its use altogether. A year later, as the shortening of the leg became more evident, use was made of a shoe with built-up sole, the outer half being thicker than the inner in order to offset the partial *genu valgum* of that extremity.

Bacteriologic examination of the pus obtained at the time of the second operation showed a practically unmixed growth of the *Streptococcus pyogenes*. The bacterium most commonly productive of epiphysitis is the *Staphylococcus pyogenes aureus*, though its type is usually not so virulent as that of the *Streptococcus*. Since the boy had been suffering previously from tonsillitis, complicated with otitis media, it is assumed that the germ gained access to the blood stream through the tonsils. The lodgement of the germs in the epiphysis is due in part to the arteries being terminal in that region, and in part to the low resistance of those structures, which at that period are semi-embryonic. The primary focus was probably the epiphyseal line; and, as this line is intra-articular at the hip, progress of the infection inevitably produced a septic arthritis. The cartilaginous condition of the head of the femur at this age resulted in detritus erosion rather than in sequestration.

X-ray plate No. 1 was taken immediately before the operation. This plate shows fairly well the extent of erosion of the head, and less clearly the erosion of the acetabular cavity. X-ray plate No. 2 was taken about three months after the operation. Although a poor plate, it shows to some extent the dense fibroplastic organization

about the femoral head. X-ray plate No. 3 was taken two years after the operation. It shows very clearly the havoc the infection had wrought, three-fourths of the head of the femur and part of the neck having been destroyed, and about one-third of the acetabulum having been eroded. Of particular interest is the involvement of the inferior ramus of the pubis. The upward displacement of the involved joint is well seen when comparing the planes of the lesser trochanters. Note also the fibro-osseous union between the remaining fragment of the head and the ilium. Shortening at this date amounted to about 1.7 Cm.

X-ray plate No. 4 was taken four years after the operation, the boy being then six years old. It shows that there has been partial bone regeneration of the ilium and of the pubic ramus, growth of the neck and head, and an extension of the synovial surface between head and acetabulum. There remains a dense fibro-osseous union which both limits action and gives strength to an otherwise weak joint. As it is, this joint is apparently as strong as the other, receives its full share of work in running, jumping, and climbing, and shows its deficiencies chiefly in limitation of extensive movement and in the limp caused by the shortening.

The accompanying cuts (Figs. 1, 2, 3, and 4) show his present physical condition. In the normal front view will be seen the shortening of the limb, the eversion of the foot, the *genu valgum* of that side, and the slight muscle underdevelopment. The other front view shows the extreme limit of possible abduction. The rear view shows the tilted pelvis resulting from the shortened limb, and the consequent, though slight, lumbar scoliosis. The side view shows the extreme limit of possible flexion, also the scar of the first incision. The child is relatively thinner than before his illness, but has had no further sickness other than measles and "colds." Chronic coryza gives an adenoidal appearance.

The left leg is now 2 Cm. shorter than the right, the shortening being in great part due to upward displacement at the hip-joint. The comparative measurements are as follows: Anterosuperior spine to internal malleolus—Left, 62.2 Cm.; right 64.7 Cm. Circumference of thigh, middle third—Left, 33.3 Cm.; right, 35.9 Cm. Circumference of knee—Left, 26 Cm.; right, 28.5 Cm. Circumference of calf—Left, 23.5 Cm.; Right, 23.5 Cm. Iliogluteal cir-

FIG. 1.



FIG. 2.



Present physical condition of patient treated for epiphysitis. (Front and posterior views.)

FIG. 3.



Extreme limit of possible abduction.

FIG. 4.



Extreme limits of possible flexion, and scar of original operation.

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cumference—Left, 52 Cm.; right, 53.3 Cm. Extent of possible flexion, 85 degrees; extent of possible abduction, 50 degrees; hyperextension of foot in most comfortable posture, 35 degrees.

The latitude and relative freedom of movement have been called unusual in view of the severity of the illness and the extent of the erosion.

In reviewing this case emphasis is laid especially on the delay in reaching a positive diagnosis. There were a number of evidences strongly suggestive of acute tuberculosis of the hip-joint, but it would seem as if this possibility might have been eliminated by the character of the temperature curve; and, though acute rheumatoid arthritis and scurvy were suggested early in the case as possibilities, they were not to be seriously considered after the full development of the pyrexia. To be sure, two of the "classical symptoms" of epiphysitis, swelling and tenderness, were absent at first, but the balance of the symptoms when associated with the oscillating temperature would seem to have justified an earlier positive conclusion.

Medicine

PSYCHOANALYSIS: ITS SCOPE AND LIMITATION ¹

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THE average physician who does not give much time to the functional nervous and mental disturbances can hardly realize the great progress that has been made within the last ten to fifteen years in the study and treatment of these diseases. To state that this part of medicine has been altogether rewritten and is still in its formative period is hardly any exaggeration. In mental diseases the vague terms of mania and melancholia have been replaced by definite entities, such as manicdepressive insanity and dementia præcox, diseases which rest on a psychological foundation and which are known to follow a definite course. In the realm of the functional neuroses the term neurasthenia is becoming more and more limited, and it is no longer used in the vague and careless manner of the old school. It is generally recognized that most of the cases that were wont to be diagnosed as neurasthenia really belong to hysteria, anxiety, and compulsion neuroses, as well as to the mild psychoses. The names of Charcot, Kraepelin, Wernicke, Freud, Bleuler, and Janet, as well as those of Morton Prince, Adolph Meyer, J. J. Putnam, August Hoch, and others in this country, will always be remembered as pioneers in these fields. All these investigators have contributed much valuable knowledge, but, as a detailed discussion of their respective endeavors is not the purpose of this paper, we shall content ourselves with saying that through their efforts many of the hitherto perplexing problems have been solved and much good has already been accomplished.

¹ Read at Pittsburgh, Pa., before the Montefiore Clinical Society, on January 25, 1915.

Perhaps the most surprising changes in both theory and treatment have made themselves manifest in the psychoneuroses, and here the name of Freud stands out most prominently. Nothing in science since the advent of Darwin's theory of evolution has stirred up so much discussion and so much opposition. Without resorting to long analogies, it may be said that just as the theories of evolution could not be stemmed despite all bitter and bigoted criticisms, so psychoanalysis has come to stay. Freud's theories are progressively accepted; his works are being rapidly translated into English, French, Italian, Dutch, Norwegian, Hungarian, Polish, and Russian; even our most unreasonable opponents now claim to use analysis and dream interpretation, and speak of shocks and early impressions as causative factors in the neuroses.

Psychoanalysis is Professor Freud's creation. It does not signify mental analysis in the etymological sense; all that can be said is that psychoanalysis is a special form of mental analysis, though not every method of mental analysis is psychoanalysis. Briefly defined, psychoanalysis is a method of mental investigation formulated by Professor Freud for the purpose of exploring the unconscious mental forces of both normal and abnormal persons. It seeks to discover the unconscious motives which are at the bases of the psychoneuroses, psychoses, as well as so-called normal actions, by utilizing certain technical means, such as interpretation of dreams and psychopathological actions. The psychoanalyst assumes that there is a definite reason or reasons for all normal and abnormal manifestations. No symptom is accidental or meaningless; there are always unconscious underlying causes which, if found and brought to the surface, become dissipated and cause the symptom to disappear. In this respect the psychoanalyst acts precisely as his colleague who resorts to physiotherapy in the examination and treatment of physical diseases. Practising psychoanalysis one finds many wonderful things; the patient is no longer the uninteresting and unwelcome neurasthenic who is best liked by the doctor when he is not in his presence, but the deeper one enters into his mind the more interesting he becomes and the more problems he presents. Finally, in the case of the psychoneuroses, when everything is brought to consciousness and the problems intellectually explained, the patient recovers. It is, however, the real unconscious motives that one must

find to bring about a cure; for the causes one usually holds responsible for the psychoneuroses are only apparent. In this respect the neuroses show striking analogies to the present world-war.

Although six months have elapsed since the beginning of this greatest war in history, no satisfactory decision as to its causes has been reached. Unprejudiced observers realize that the stock reasons advanced by either side cannot stand the test of examination, and that the assassination of the Austrian heir to the throne, the Russian mobilization, and the violation of Belgian neutrality can only be designated as *agents provocateurs* or exciting factors. The war was expected for many years. When we take the anamneses of nervous and mental cases we are usually told that the disease followed a physical or mental shock, such as a fall or fright, but experience shows that the patients were not quite normal long before the particular cause made its appearance. Moreover, many close observers maintain that for some time—many years—Europe underwent many changes in population and other civic and economic factors, and that the present struggle is an effort to establish a new balance of power. In other words, the nations who have grown weaker and smaller distrust and fear the nations who have grown bigger and stronger, and by forming new alliances they hope to reestablish the proper equilibrium. When we examine the individual psychotic we find similar disturbances in his mental and emotional life, and the symptoms are only a manifestation of the mental conflict and the attempt at readjustment. They also make their appearance at some critical period, say the age of puberty or menopause. Every individual is a microcosm and continually adjusts himself to his macrocosm. As a rule he succeeds, now and then a crisis ensues, and, depending on his constitution, the form and amount of disturbance, we have either a neurosis or psychosis.

Last May I saw a woman of sixty-five years who showed many paranoid ideas. Her daughter told me that for years before she was very depressed and delusional, she was afraid of death, was very religious, and expressed many irrational ideas concerning dead people of whom she was afraid. When I saw her she was happy and contented and was not afraid of anybody or anything. She told me that she saw spirits, with whom she could talk whenever she desired. When I asked her who those spirits were, she said that they were her

dead husband and a Mr. X., with whom she was in love in her girlhood. The latter told her not to worry at all, that everything would be well and nice when she passed out of this world, and that both he and her husband were waiting to receive her.

Here one can see how nicely this woman adjusted herself to her new world. Her mental disturbance followed an attack of nephritis during which she was quite sick. As a reaction to her fears of death and dead persons she now holds communion with the two dead men whom she loved and trusted most in life, and they tell her not to fear or worry. She has been in this condition for over ten years, and adjusts herself very well to her strange world.

The adjustment of psychoneurotics and of normals follows a different order, but here, too, changes occur. A woman who has been through a disturbing love affair, with or without an hysterical outburst, is quite different in her reactions after the attack from what she was before.

To continue with our analogy to the war, I will say that I do not think that any one will disagree when it is maintained that this war is not a manifestation of brotherly love, but that it is dominated by greed, envy, hatred, and fear. When we enter into the deeper mechanisms of the neuroses and psychoses we find that they, too, are the expression of a conflict between the individual's primitive impulses and society. Thomas Hobbes's *Bellum omnia contra omnes* is as true of the individual as of nations.

Just about two years ago I was consulted about a young lady who was suffering from nervousness. Her mother, who came to see me before she brought the patient, told me that her daughter had been very nervous for about nine months; that she was obsessed by the idea that she was going insane, that she was subject to crying and trembling spells, that she slept poorly and had no appetite. She could give no reason for her daughter's nervousness, which she claimed came rather suddenly after the following shock: An insane boy from the neighborhood jumped at her and frightened her with his wild eyes. The young woman was twenty-nine years old, slightly burdened by heredity, of average intelligence, and showed nothing wrong in her physical condition. Mentally she appeared very depressed and emotional. She cried when I began to examine her, but answered questions promptly. She was nervous because she was afraid of

insanity; she was treated by a number of doctors, who gave her hydrotherapy rest cures and medications, and, as she was not improving, she considered herself hopeless. To my question she answered that she was tired of living, that she had no right to live and make others suffer, and that she was not worthy of sympathy. She did not, however, seriously think of suicide.

This case was looked upon as a traumatic hysteria as well as a depression of the manicdepressive type.

The psychoanalytic theories have been so often discussed that I shall mention here only a few of their essential points. Originally Breuer and Freud used what they called the cathartic method of treatment.² It is based on the theory that hysterical symptoms depended on past emotional experiences which were repressed and forgotten. The therapy consisted in hypnotizing the patient and causing him to recall and reproduce these experiences, thus giving expression to emotions which for some reasons could not be given vent to before. With this abreaction the symptoms disappeared. It was a sort of mental catharsis; the patient's attention was directed to the traumatic scene which gave rise to the symptoms, the psychic conflict was found, and by giving him the opportunity to discharge the repressed emotions he became freed from the symptoms. During these proceedings it was regularly found that the patient's associations did not stop at the scenes to be explained, but went back to much earlier experiences, usually to childhood; hence, in order to correct the psychic entanglements, it was necessary to occupy oneself not only with the present but also with the patient's past. It was also found that not every person could be hypnotized, a fact known to every worker in this field, so that gradually Freud developed what he called the psychoanalytic method. Here no hypnosis is necessary; by a process of psychologic work the patient can be made to reproduce everything without hypnotism. The procedure is as follows. Freud makes use of what he calls the "continuous association" method. The patient is told to concentrate his attention on a certain point and tell everything that comes to his mind, regardless of whether it has any visible relation to the point in question. This always brings up associations which were repressed because they were of a painful

² For detailed discussion Cf. Brill: "Psychoanalysis: its Theories and Application," Chapter 1, 2d edition, Saunders, Philadelphia.

and disagreeable nature, and the psychic efforts which inhibit these associations from coming to the surface are designated as resistances. It was while examining patients in this manner that Freud developed his theories on sex and the interpretation of dreams. It is the theories on sex that cause so much resistance to Freud's work. Were it not for the bold statement, "In a normal sexual life no neurosis is possible," there would be little if any opposition to Freud. It is hardly possible for me to enter here into a deep discussion of this question. I shall merely repeat what I said so often, viz., that the term sex is used by Freud in the broad sense of love,³ and will add that after eight years of continuous study I can corroborate Freud's dictum, viz., that in a normal sexual life no neurosis is possible.

Now let us return to our case. What I pointed out in my prefatory remarks concerning the causes of the war I can apply to the causes of the emotional disturbances in this patient. All the relatives were convinced that the cause of this young woman's trouble was the fright she sustained through the insane boy, but a little questioning soon showed that months before this occurrence the patient was not quite well. The patient was very uncommunicative or rather barren of ideas; she assured me that she was quite willing to tell me everything, but that she did not know what to tell me. Her life was uneventful; she had no love affairs to speak of. A young man did pay attention to her some time before, but, as she did not care for him, nothing came of it. When I pressed for details she insisted that there was nothing to tell. On one occasion she was very emotional and cried much, and when I urged her to give me her reasons for it she said that she was thinking how cruel and wretched a creature she was, and finally she told me that she was crying so much because she drowned some kittens about twenty years ago. She was then living in the country and there was a litter of undesirable kittens and she drowned them. To my question she said that this scene was rarely recalled before she became ill, but since then it had often returned to her mind, and caused her much depression. She herself could not explain why she thought of this particular scene after so many years, and what was still more strange was the fact that her mother positively denied that she ever did this. I spoke

* Cf. Freud: "Three Contributions to the Sexual Theory," translated by A. A. Brill.

to her mother about it, and she assured me that her daughter never drowned the kittens, but that she probably witnessed it when a farm hand did it.

Now in psychoanalytic work such trivial episodes cannot escape us; we always ask, What does it mean? I naturally endeavored to get the patient to explain it, but she could not give me any information. She belonged to those who claim that they do not dream, so that dream analysis could not help me. In my discouragement I asked her to make up a dream,⁴ and after much instruction she made up the following dream: "*I see a horrible, ghastly object; it is some animal; it breathes under the water. I wish to pull it out, but I cannot. Now it is coming up.*"

This, as you see, is an artificial dream made up, as it were, of whole cloth. In a paper recently published,⁵ where I quoted this very dream, I have shown that artificial dreams have the same value and evince the same mechanisms as actual dreams. For years I have resorted to artificial dreams whenever real dreams were not forthcoming. It will also be noted that this dream shows a decided resemblance to the reminiscence of having drowned the kittens. Now as to the analysis of the dream. The dream as recalled by the dreamer is called the *manifest dream*, and in order to analyze it we must find the *latent thoughts* of the dream.⁶ Here I would have been again confronted with the same difficulty, viz., the patient's inability to give continuous associations, but I had enough material to get along without her help. We have now reached a stage in our psychoanalytic work where we can sometimes judge concerning dreams and symptoms without the full coöperation of the patient, although to produce good results the patient's coöperation is absolutely essential. There were a number of factors that struck one as peculiar. I asked myself, Why should she have recalled this kitten drowning episode? Why cry over it twenty years later? Clearly there was a marked disproportion between the affect and the idea, and experience teaches that in such cases the emotions are only displaced; they belong else-

⁴ Cf. Brill, l. c., p. 77.

⁵ "Artificial Dreams and Lying," *Journal Abnormal Psychology*, January, 1915.

⁶ Freud: "The Interpretation of Dreams," translated by A. A. Brill, the Macmillan Company, New York.

where. Moreover, whenever I spoke to her mother she never failed to volunteer the information that her daughter was a very good girl, that she never cared for the men, and, as I never gave her any cause for telling me this, I became convinced that the mother suspected something of just the opposite nature, and for that reason she felt the need of protecting her daughter's innocence. I had no doubt that it was entirely unconscious on her part. Now what are the main elements in the kitten drowning reminiscence? The destruction of life by means of or in connection with water. What are the main elements of the dream? Something horrible and ghastly breathing under the water, and a wish to pull it out. I decided that this young woman had something to do with an abortion, and after overcoming very strong resistances she reproduced the whole episode. Over a year before she came to me for treatment an abortion was performed by a physician after she herself tried very hard to bring it about through medications and douches. The fear of insanity was due to a masturbation conflict, and also to the fact that the insane boy, who turned out to be an idiot, was supposed to have become so through masturbation. This also explains the fact that she was frightened by the boy's wild eyes. As you know, masturbators have the idea that they can be recognized by their eyes. This young woman lost her symptoms a few weeks after the analysis of the dream.⁷

This case, which I diagnosed as an anxiety hysteria, teaches that the so-called traumatic hysterias are really not due to the traumata: these are only exciting causes which help to determine the symptoms. Analysis always shows that there was a ready soil for the attack. Care must also be taken to differentiate such cases from the depressions of manicdepressive insanity,⁸ and one should always examine the sexual factors. They are always to be found, although it may not seem so to the inexperienced.

⁷ I regret that I cannot here complete this case by showing the subsoil of this psychoneurosis from early life. It is to be noted that the cat played a prominent part in the patient's life. From early childhood she entertained an ambivalent feeling (love and hatred) for this animal, and repeatedly identified her mother and herself with it. (Cf. Freud: "Totem and Tabu," an English translation of which is in preparation.)

⁸ Brill, *l. c.*, p. 91. An important diagnostic point is retardation, which is almost always absent in psychoneurotic depressions.

Recently a young man who is under my care told me that his memory went back to the time of his baptism, when he was about a week old. He said that he remembered distinctly the house, the stairway leading up to the first floor where he was supposed to have been baptized. He particularly remembered a lamp standing at the foot of the stairs, a tall man in a black frock coat who was the minister who held him. He also recalled vividly how his head was totally submerged in a basin of water. I was naturally sceptical and explained to him that I would call this a *concealing memory* which probably hides something else of a much later date. He then informed me that he had entertained this memory for many years, but that when he told it to his mother a few years ago she laughed and said that there was no truth in it; that he was not born in this particular house, but that he lived there from the age of four to six; that she could not recall this peculiar lamp, and that the minister who really baptized him was not tall, and, what was more, that babies' heads are not submerged in a basin of water during baptism. Yet, notwithstanding his mother's denial, he continued to entertain this memory, and told me that he felt that it was true in spite of all facts to the contrary. I called his attention to the fact that his mother had no motive for denying it, and that so far as I know it would be impossible to retain anything from so early an age. We then proceeded to analyze it. He stated that the most vivid element in that memory was the lamp, so that I asked him to concentrate his attention on it and tell me what came to his mind. He could see the lamp at the foot of the stairs, the stairway, and the room on the first floor. He then recalled that at the age of about five years he was standing one afternoon in that room watching a Swedish servant who was either on a high chair or step-ladder cleaning the chandelier. He became very inquisitive sexually, and made a great effort to look under her clothes. She noticed it and gave him a strong rebuke. He then recalled that a few years later he watched through a keyhole to see his mother dress, and somehow she caught him in the act and punished him very severely for it. He was very much humiliated because she took him downstairs to the dining-room and told his father and brother, who were then at breakfast. About the same age, probably before this episode with his mother, he was on the roof one evening and saw a woman undressing in a house

across the street. He became very excited, and ran down to call his brother, but when he returned the woman had a nightgown on and soon pulled down the shades. He told me that for years he regretted that he did not wait to see her undress. He reproduced more scenes, all of which dealt with frustrated sexual looking. The lamp therefore represented a contrast association of darkness which stood in the way of his sexual inquisitiveness, and that is why the lamp element was so accentuated in his memory. Now, why did he remember the fact of his baptism? This young man is a good Christian, his parents are Christians, but his paternal grandfather was a Jew. He himself shows no trace of the Semite, but the only thing he retains from his grandfather is the name. It is a German name which is often mistaken for a Jewish one, and for this reason it has given him much trouble. He thinks that he was refused admission to college fraternities because he was suspected of being a Jew, and only a few years before he was again refused admission to a society on account of his name. The concealing memory of his baptism is thus a compensation for his suspected Judaism, and that is why it retained its vividness, his mother's denial to the contrary. He had to be assured that he was baptized and therefore was a Christian. Altogether the memory represents a religious scene in order to hide an immoral scene which took place in this room.⁹ I will add that at the age of puberty there was a complete repression of all sexual elements, and he became a model boy in every way. He is now over thirty-six years old and never had any kind of relations with the opposite sex. He is a shy, seclusive, reserved personality, and is remarkably ignorant of everything sexual. This is only a reaction to his early immorality, and was brought about by the various shocks or set-backs he sustained in his effort to adjust himself to his adult sexuality.

Now these things may seem very commonplace and unscientific, but let me remind you that just such episodes play a part in the life of every individual, and that the average nervous patient does not think in philosophical and abstract terms any more than he thinks in terms of histology and pathology. The human mind resorts to everyday language and feelings, and in the neuroses and psychoses we

⁹ Freud: "The Psychopathology of Everyday Life," p. 57, translated by Brill, the Macmillan Company, New York.

invariably find just such mechanisms. One of my patients who was about to graduate from a university invited his best girl, with her mother, to the commencement exercises. He had known this young lady since his early boyhood, and had often invited her to college functions before he entered this university. He was a member of a fraternity, and whenever she and her mother came to one of these college affairs they stopped in his fraternity home. It happened that his fraternity had no home in this university, so that in his invitation he apprised the young lady of this fact, and informed her that he had engaged rooms for her and her mother in a nearby hotel. He added, "I am very sorry that I cannot offer you the luxurious surroundings of a fraternity home," but instead of writing "fraternity home" he wrote "maternity home." You see, it was just an innocent *lapsus calami* which should have offended no one. But imagine his surprise when, instead of getting the usual nice letter of acceptance, he received his letter back with a chilly note asking for an explanation of a remark in the letter. He read his letter over and over again and could see nothing wrong in it, and to solve the puzzle he asked his roommate to read it and to tell him what was wrong in it. His roommate read it only once and discovered the mistake and laughingly pointed it out to him. He then realized that he made a mistake in writing, but he was still more puzzled why the young lady and her mother should have been offended by an innocent mistake. He at once wrote a letter assuring them that he had just made a mistake, and the young lady, chaperoned by her mother, attended the commencement exercises. Here the mistake was determined by the fact that while writing the invitation he also bemoaned the fact that he was not yet ready to think seriously of marrying the young lady, hence the mistake, "I regret that I cannot offer you the luxurious surroundings of a maternity home." The strange action of the young lady and her mother may be explained by the fact that they could see through the mistake and were probably pleased, but in their effort to remove any suspicion from themselves they had to sham resentment, which only betrayed them. They showed what Bleuler calls a "complex readiness" (*Complexbereitschaft*). I will add that some time later this young man developed a compulsion neurosis, and one of his symptoms was his inability to write and send away letters. He would unseal his letters

and read them again and again in order to discover whether something improper did not slip in. Here, too, the neurosis was attributed to this insignificant episode, which was not at all the case.

I have purposely selected short examples to illustrate in as simple a way as possible our mode of working. It would have been quite impossible to bring before you one fully analyzed case, because it represents the work of many months and usually fills a good-sized pamphlet. As I said above, the conflicts at the bottom of the neuroses are of a primitive nature; they represent infantile or archaic forms of thinking, and as such are not only incomprehensible to the individual concerned but also to the average physician. It is the object of psychoanalysis to bring all these tendencies to consciousness and help the individual to solve his difficulties, and in doing this one has to consider not only general tendencies but individual differences. Every person has his own mode of reaction to this world, and the only way to discover the truth is by studying his unconscious productions in the form of dreams and psychopathological actions. I find, for instance, that not only does every individual have dreams which show definite characteristics, but one can often tell by the dreams the individual's environments. In this connection I wish to report a rather curious phenomenon. I find that Southern gentlemen often have erotic dreams in which colored women play parts. I never found this among white cultured men who were brought up in any other section of the country. This is explained by the fact that Southern white children, and particularly of the better classes, are invariably brought up by negro mammies, who in almost every respect take the place of their own mothers during the most impressionable period of their existence. Psychoanalysis has shown the enormous part played by parents in their offspring's future existence. Selection mainly depends on early parental influences.¹⁰ The man is always guided in his selection by the image of the woman impressed upon him during infantile life. The average man brought up by a white woman finds no charms in colored women, and even among the lower class it is rare to find that they show any tolerance, not to say preference, for a negress. On the other hand, I was told by many cultured Southerners that many white Southern men often consort with colored women. That accounts for the hundreds of mulatto

¹⁰ Brill, *l. c.*, p. 288.

children that are annually born in the South. In New York, for example, such births are comparatively rare.

Psychoanalysis not only helps and cures, but, for the first time in the history of medicine, we are now getting some insight into the psychoses and neuroses which is of utmost importance in prophylaxis. Thus a patient told me that he suffered from peculiar feelings of fright which came on suddenly. The last attack appeared while he took a walk in the slum district of New York, when the idea suddenly flashed through his mind: "Suppose one of those rough characters should assault me or kill me!" He became very much frightened, his whole body shook, and this fear continued for over three hours until he came home. When I asked him why he did not leave that neighborhood, why he remained there so many hours, he could not answer. He thought it strange that he had not left this neighborhood sooner. I suggested that he must have liked to be frightened; he smilingly admitted that I was right, and then confirmed my assumption by reciting many occurrences of a similar nature. He told me that while travelling abroad he often engaged a guide to take him out, and so soon as he began his tour he would get frightened and keep it up for hours.

This man was a masochist who was made so by a brutal father and a cruel tutor. He was brought up more like a trained dog than a human being. He was not allowed to play with other boys, and the slightest boyish transgression brought swift and severe corporal punishment. If he misbehaved, the servants threatened with the bugaboo man and with the devil. In his loneliness he became a prolific reader of fairy-tales and similar literature, and so far as he could recall he lived through in his fancies those characters who were despised, punished, and assaulted. Later in life he found the need for such reaction; in other words, he found pleasure in pain, and unconsciously and sometimes consciously brought about such situations.

Since Jean Jacques Rousseau we know the dangers of corporal punishment of children, but little attention has been given to the psychic influences in the early period of development. Most of the reading material in the form of fairy-tales offered to children does much harm.¹¹

¹¹ Brill, *l. c.*, p. 293.

Perhaps the strangest part of this case is the fact that all his life he consulted physicians—he is forty-five years old—and none discovered the true nature of the case. He was told that he was a neurasthenic, was given sedatives and tonics and ordered to take trips to different parts of the world. It is a sad commentary of our medical education. Every physician, whether he is a Freudian or not, should have a good knowledge of psychosexuality, and should examine the psychic and sexual life of all his patients. That does not mean that every physician should treat his patients psychoanalytically. Psychoanalysis is a branch of psychiatry and neurology, and to practise it one should have a previous training in these specialties or should work together with one who possesses these qualifications. For not every case can be benefited by psychoanalysis or should be subjected to that treatment. Only psychoneurotics of a certain mentality, age, education, and character can be cured.¹² Since 1908 I have also analyzed mild mental cases of the *præcox* and depressive types with varied success, but nothing definite can be said at present about the results.

¹² For detailed discussion Cf. Brill, *l. c.*, pp. v. and vi.

EFFORTS AT ADJUSTMENT

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WHEN thought processes become a source of disturbance to an individual, or when they lead him into untoward acts, he seeks the advice of the clinical psychologist. What he wants is peace of mind, and unfortunately he usually waits until that peace has been very definitely upset. A broken bone will knit together again, whether controlled to grow anatomically correct by means of the surgeon's art or not; the liver or any other organ will attempt to heal itself even without the physician's aid; in like wise will the various mental faculties adjust themselves when anything goes wrong with their mechanisms. Ordinarily we think of the term adjustment as implying a successful issue; in point of fact, there is always an arrangement of some sort effected, the important thing from the standpoint of the individual being whether the new relationship spells happiness—in other words, whether there has been successful adjustment.

The two cases which I will briefly outline here are examples of unsuccessful adjustment. They have been chosen because they present unusual features in so far as the form which the adjustment took is concerned. The first case, one of somnambulism, was treated intermittently for over a year, but a thorough analysis of the mental processes was never accomplished. The second case, a sort of human hibernation, was examined but once by the writer and could not be studied further, because he lives about two hundred miles away.

CASE I.—Miss X, who first wrote stating that she wished to consult me about giving her an hypnotic treatment. A subsequent visit revealed a neat, precise little woman of forty-one, very intelligent, demure, quiet, and unassertive. She is a teacher by profession, and her work is very tedious and exacting. Her trouble had begun four years previously, just after returning from a visit to her parents in the country. At that time she was living with four other teachers, who first made fun of her, later became afraid, and the

patient finally had to move. The patient had suffered a number of similar experiences in other rooming houses after that, and this was the reason she gave for wishing to be cured. Her sleep-walks gave her no personal annoyance otherwise.

She had been worrying considerably for some days past about the winter's work before her, and, aside from the details of arranging courses, etc., she felt rather discouraged at the prospect of merely being able to accumulate enough money to again support her parents the ensuing year. This latter, however, she hardly dared admit to herself, and she took what pleasure she could in realizing that she was again in New York, among energetic people, with an opportunity to visit the theatre now and again, to perfect herself in her chosen work, and so on.

The patient was born and brought up in the country, accustomed to getting up early and working hard all day, with very little amusement except what she could obtain from roaming the fields and hills, communing with nature. She always felt that she was different from other girls, and her own mother, an attractive woman, did not hesitate to tell her so. She liked her father better because he seemed able to understand her, and the two would often roam about the country together. The father was also of a romantic and philosophic turn, but he possessed rather set and puritanical ideas as to how children should be brought up. On one occasion, because he knew that the patient was afraid of lightning, he got his little daughter out of bed at night and took her for a walk in a heavy thunder shower, as a result of which both were thoroughly drenched. The child was made to appreciate the beauty and comparative harmlessness of lightning, however, and she ceased to be fearful after that. On another occasion he persuaded her to walk alone on a narrow plank of some high scaffolding because she had expressed a fear of high places.

When about twenty years of age the family took in boarders—teachers who were attending a school nearby. These teachers frequently teased the patient about her countrified ways, which hurt her feelings a great deal, but which she kept to herself. The stories which they told of city life fascinated her, and so the seed was sown which later developed into an irresistible desire to go to the city. She finally determined to leave home at all hazards, borrowed money from neighbors, and subsequently entered a school in Boston. Here she made rapid progress and was graduated with credit. It had been her original intention to return home to live after completing her courses, but the work in a large city attracted her so that she later came to New York to live. She was in residence and much confined within doors in her first position, which she left to assume a similar one in another institution. It was in the latter place that the close application of her work "got on her nerves," and she began to study another subject which would bring her into more immediate contact with human beings. In addition, she developed the habit of wandering along a fairly crowded thoroughfare, sometimes at night, with no very definite purpose in mind, yet conscious of the fact that she was seeking adventure of some sort—possibly with a member of the opposite sex. She always returned disappointed, but would always start out again with renewed hope. Her work became more and more boresome, so she gave it up and went in for private teaching, at which she has been very successful ever since.

The patient's father was injured several years ago and has been incapacitated

for sustained work. The mother had been an invalid even before that, and soon after leaving Boston, at the age of twenty-seven, the patient assumed practically the entire responsibility of caring for her parents financially. For this reason she was never able to accumulate any money which she might call her own. She has an older brother who is married and lives away from home. He suffers from asthma, is sickly, and cannot contribute to the support of his parents. In disposition he is much like his father, and the patient has always taken a great interest in him. She has also an adopted sister a few years younger than herself. This girl has always been rather erratic and, the patient says, of a quite opposite disposition from herself. She was separated from the patient when a baby and brought up by an uncle. Family history otherwise is negative. The patient had asthma in childhood—otherwise no serious illnesses.

The patient's romanticism has been a dominant feature throughout her life. She claims never to have fallen in love, but is attracted to and admires intelligent men who are older than herself. She has never had any intimate friends. The persons she likes do not care for her, and *vice versa*. She often finds herself eager to adapt herself to some one with a disagreeable disposition. She thinks her father is of this type. The patient has always been considered very reserved and peculiar by her friends. She is a very efficient teacher, takes an interest in the work for its own sake, but often becomes disconsolate and annoyed at her pupils and sees no future ahead for herself. During her spare time she prepares her lectures, reads romantic or philosophical novels, attends the theatre or opera, or takes long walks in the city. On several occasions she has gotten up early in the morning and gone down to the lower East Side to contemplate the people hurrying to work. She still delights in the sky, the fields, and the woods. She likes to let her thoughts drift in a purposeless fashion. "Tristan and Isolde" stands forth as being the most beautiful of operas. If a play appeals to her she will go to see it several times. Fairy-tales and plays like "Peter Pan," with "beautiful pictures" and "beautiful words," fascinate her. She rarely recalls dreams, and they are usually of disagreeable happenings at home. About a year before her chief complaint occurred she began to interest herself in mysterious things. She has no use for women. She thinks she developed late, so far as worldly maturity is concerned. She never heard of sex matters as a child—cannot recall a single, definite sexual emotion. She has always been self-reliant, and has been considered the "man of the family" ever since she assumed that responsibility. She lives in the constant dread of hearing of her mother's death, which would mean her being compelled to leave the city, give up her work, and care for her father. She enjoys her visits home, when she works hard and "straightens things up," but she soon yearns to be back in the city again. She considers herself very practical.

The patient's beginning attacks of somnambulism seemed to occur more especially after a hard day and from one-half to one and a half hours after retiring. They happened at irregular intervals, sometimes every night and at times but once or twice. She would suddenly throw off the bed covers, step out of bed, walk into another room—occasionally opening a door to do so—and, as a rule, was rather voluble, coherent but rambling; would say, "How stupid the women are! Won't somebody help me?" etc. When urged to return to bed she often became resistive and would cry, "I won't do it," repeating this over and over with determination. As a rule, so far as can be determined, she

clenched her fists, but never had either a tonic or clonic convulsion. After a half hour or less she would again fall asleep and remain quiet the rest of the night. She rarely recalled anything having occurred to her the following morning, but believes that sometimes, during the attack, she was conscious in a cloudy and confused manner and realized when some one was standing near. Other features of grand mal, petit mal, or Jacksonian epilepsy were absent. She never displayed any homicidal or suicidal tendencies during the attacks.

Upon examination she presented no physical or neurological signs or symptoms; enjoyed good health; menstruation was still present and history uneventful; no mental reduction apparent.

After six weeks of these attacks she consulted a man who practises hypnosis and who is said to have placed her in an hypnotic state by having her lie down, giving her something to drink, placing his hand upon her forehead, and bidding her sleep. The patient was in this state from 2 P.M. until 7 P.M., walked about the office, talked in a rambling fashion—content not ascertained—heard what was being said about her, but was herself unable to reply, was finally taken home by her companion in a cab without having regained complete consciousness, was put to bed, and did not come to again until 7 o'clock the next morning.

Despite this experience the patient felt as though she had been helped, and, in fact, she did not walk in her sleep again for about two and a half years. However, instead of somnambulism, for some three months after the treatment noted above, the patient had a sensation as though she herself—her double—was always standing by her side. She never could see the figure, but she felt its presence, which was definitely localized to the right and slightly back of her. This "other self" would repeat everything she said, and when lecturing it would "shriek" so loudly that the patient would often look at the class to see whether they had also heard.

One day, during this period, she rode in the cars about the city for many hours in a dazed, confused, and semiconscious manner, not knowing where she wanted to go or was going, but finally arriving safely at home, fully conscious. Aside from this she felt well and happy, and, after the sensation of her double being near gradually disappeared, the patient enjoyed good health and went to the theatres, etc., as of old.

The sleep-walking began again one fall, after returning to New York from a visit home, and in character was about the same as in the beginning. After six months she consulted me and asked to be hypnotized, because she thought it had helped her so much the first time.

This was done, and the patient proved to be a very good subject. At the same time, however, psycho-analytic procedures were instituted, although it took a number of treatments before she had any faith in the latter. Hypnosis was what she wanted above all else.

Within two months it was learned in sufficient detail what her main mental conflicts were, and, furthermore, the assumption was made that the somnambulism was nothing more than auto-suggestion. By this time the attacks had greatly diminished in frequency, due to the suggestion under hypnosis that she would not walk in her sleep any more, but the patient would not believe that she was merely hypnotizing herself when she did these things. Therefore the following experiment was made:

The patient was asked to lie upon a couch, close her eyes and imagine herself in her own room, in bed. In about thirty seconds, without a word being said to her, she arose from the couch and walked about the room, eyes open, and in a manner identical with the somnambulistic attacks described previously. The patient was returned to full consciousness by shaking her and clapping the hands loudly.

She did not walk in her sleep again for several months and considered herself cured.

However, since that time the patient has had periods in which she is free of attacks of whatever kind, others again in which there is somnambulism every night or less frequently, and then times of longer or shorter duration when apparently there are equivalents and she suffers depression, exaltation, etc. Usually another hypnotic treatment will bring about a free interval—also medication or a psycho-analytic talk has accomplished this—but unfortunately the patient then always ceases treatment and later on something again happens.

On several occasions, always after a hard day, she has lost control of herself on the street or in the cars and has wandered to my office in a state of confusion not unlike the automatic state of grand mal. If left alone she will come to herself again without any treatment, and is always most surprised to discover where she is. From what she says these states come on suddenly, without any warning. She is always more or less resistive at these times and will carry on a conversation, but not if asked questions which are irrelevant to her general stream of talk.

On one such occasion she talked as follows in the office, no conversation being directed to her on the part of the examiner:

"So many doors shut—so many doors shut—doors of opportunity—it's a great pity, isn't it?—a great pity—mother says it's a great pity—mother says it's a great pity I was born—the doors are not only shut, but locked—The world is very hard—I don't want to make it harder for people, but easier—I wouldn't hurt anybody—Perhaps you'd tell Dr. Bisch I'd like to see him—you know, Dr. Bisch is my doctor and my friend—Won't you please tell him I'd like to see him?—I can't remember where he lives—It's the far-away things I want—I will have to go now"—(here patient goes to the door and tries the lock)—"The doors are all shut—There isn't a bit of air in this room and I've got to get out of doors"—(here patient tries another door)—"I think I shall have to go out now—Don't you hear that?—that ringing, singing, Canterbury bells?—I can hear them so plainly—it doesn't do a bit of good to scold me—I wouldn't do this if I could help it"—(here patient becomes tearful)—"it doesn't do a bit of good to scold—I shall have to go now"—(here patient again tries the first door, which is locked)—"Won't somebody open this door?—It's ages since I started—I doubt if I'll ever get there—Mother says it's such a pity you were born—I haven't the courage to kill myself—I absolutely haven't the courage"—(Here patient raises her arms, then holds her head and reels as if about to fall, but she does not, although unsupported. At this juncture the examiner shakes the patient and says, "Pull yourself together." She does so at once and is very embarrassed.)

Whenever the patient gives up treatment she is accustomed to write the examiner and to talk about her condition and attempt to put her feelings into words. Excerpts from these letters, received at various times, are as follows:

"Alternately I am on the heights and in the depths. The heights I suppose you would call ecstasy, and the depths depression. It began at — church last Sunday, while looking at the Christ picture and listening to the beautiful music. I think peace descended on my soul (or whatever part of my anatomy peace is supposed to reside) about the time this hymn was sung, 'Tarry with me, O my Saviour,' etc. It's not all religious exaltation, for Hauptmann's 'Sunken Bell' sends me off at a tangent—I can—as you well understand—endure these conditions with more fortitude than I could the others.

"I wonder if you would have been interested if I had made away with myself—and a few others—as I seemed determined to do." (When the patient was later asked whom she meant by "a few others" she reluctantly admitted her parents, and said she had been very much ashamed of it since.)—"Now I am all right. It seems to me like a disease—it runs its course to the bitter end.

"As to my 'walks'—I am perfectly all right now. I presume that you will want to know if I am still seeing visions and dreaming dreams. Here is my answer: 'Where there is no vision the people perish.'—Why can't life be a sun-path and not a dull morass beneath the moon?

"My happy longings have vanished. I can't work my pretty fancies—they are all gone. I am ready and very anxious for my next reincarnation. Surely there must be something beyond this well worth having—and it seems as though I couldn't wait much longer. My love for my father and mother is almost overpowering."

At the time of writing the patient is with her parents in the country—the father being in a critical condition—and the patient has been enjoying absolute freedom from attacks of whatever sort for the past three weeks.

Whether one calls this case one of hysteria, psychic epilepsy, somnambulism, or auto-suggestion—even a suggested dual personality—seems of little moment. To the examiner the important thing—from the standpoint of improvement or cure—lies in the really unsuccessful adjustment of the patient's mental conflicts, the two salient ones being her sense of duty to her parents on the one hand, which was opposed to her desire for freedom on the other. To tear herself away from this strong parent attachment, to romance and marry, would have been a normal development in her, as in every other case. This, however, she was unable to accomplish. The basic, subconscious, causative factor for these overpowering motive forces in which she identified herself as being head of the household seemed to lie primarily in an unusually strong father complex, but, as stated in the beginning, a complete analysis could not be done. The patient herself was neither able to give up her romancing nor the care of her parents, and one way of removing herself completely from this

conflict was to die. In fact, during the automatic-like state noted previously she said she lacked the courage to do so, and, furthermore, she once said during an hypnosis that she did not wish to live. Then, in order to harmonize more completely with conscious activity—to substitute death—the adjustment went even further, and in consequence her own mental mechanisms brought about periods of self-hypnosis, during which times she removed herself temporarily from her conflicts, could give expression to her fundamental wishes, and yet consciously be held irresponsible.

The patient has not been cured, but apparently she has been improved. Only time was allowed to bring out the main trends. That suggestion played an important part in the treatment cannot be doubted, but it would seem that suggestion accomplished on a logical, analytical basis has more therapeutic value than suggestion without it.

[*Note of April 4, 1915.*—While Miss X remained with her parents she was most solicitous for her father's welfare, and she returned to New York only when his illness took a decided turn for the better and the necessity to earn more money in the city became most urgent. She has been here for four weeks and at irregular intervals has had attacks of somnambulism, alternated by three visits to my office in a state of trance. While with her parents she was free from these manifestations, but complained of a general feeling of confusion at times, with one very decided period of depression.]

CASE II.—Mr. Y, who was reported to me as follows:

"The patient is now fifty-five years old and has been sleeping winters and staying awake summers for the past ten years. His sleeping spells are evidently lasting longer each year, his last one continuing for eight months. While in these semicataleptic states he is thoroughly conscious of what is going on; eats fairly well, but not as much as during the summer; gets up to attend to his bodily functions; is apathetic all of the time; will talk when sufficiently aroused, but prefers to keep quiet; loses about thirty pounds in weight (last winter he lost thirty-five). Two years ago he weighed 205—now only 165. During the summer he eats ravenously, and up to the present summer has gained what he has lost during the winter.

"During his wakeful period—from about April 1 to October—he is restless and keeps going night and day, excepting for about two hours at night, when he lies down, but seldom sleeps. He hitches up his team and drives out around the neighborhood, paying no attention to time and often arriving home at one o'clock or even later in the morning. He usually starts out with some objective point in view, but doesn't always get there. He stops and visits with everybody, and apparently loses all sense of time or responsibility at home. He secretes

from his wife what money he can procure by working around the neighborhood. This he spends in a shy manner on peanuts—sometimes for drink—and he will not let his wife know how much he has earned, where he got it from, or how he spends it. His wife owns the farm and does not allow him much latitude in the handling of money.

"On one occasion he accused his wife of feeding him something which has caused his condition, and his wife has had him examined by local physicians, who recommended a hospital for the insane. He is generally considered "crazy" in the country thereabout, and probably has heard it said that he would be better off dead.

"The patient is rational in his speech, relevant, reads a fair amount, and is fairly well posted on affairs in general. He is rather an expert farmer and talks very intelligently about crops, weather, and farming methods. He always seems to live in the present moment, with no thought of the future.

"He occasionally has a slight shaking of his hands and arms, during which times he raises both forearms slightly for a short time. This is not accompanied by unconsciousness. He says that during his sleepy spells he occasionally has flashes of light before his eyes, and that if he gets up for a few minutes the flashes disappear. He also occasionally complains of indigestion.

"His first sleepy spell came on ten years ago, while he was driving his team on the mowing machine one very hot day. He said his head dropped forward and he felt dizzy and weak. He thought he had had a sunstroke and went to bed. He slept for a day or two, and then returned to his work. That autumn he hibernated for the first time.

"There is nothing exceptional in his family history. He came from reliable and well-to-do rural people. He has a brother, a photographer, who, according to the patient, is 'very restless' during the summer. The patient has married twice. His first wife was quite a 'sport,' and he obtained a divorce from her. She is reported to have said at the time of separation that she had lived with that d— fool long enough, from which it might be concluded that the patient was peculiar even when young."

My own examination elicited the following:

The patient has three brothers, fifty-eight, forty-five, and forty, and all living and well. There are no brothers dead, and he never had any sisters. His father died at sixty-eight from "inflammation of the bowels," and his mother died at fifty-two with the menopause assigned as the causative factor.

Y married his first wife at the age of twenty-two, and there were only two children—boys—both of whom are married. One has no children, while the other has two that are said to be bright and normal.

He divorced his first wife at thirty-five, having been much worried about her. He married the second time at forty-five. His second wife bore him no children and she has never been pregnant.

The patient left school at the age of twelve, and has worked at farming ever since. He claims never to have had any serious illnesses, although up to the age of thirteen he suffered from stomach trouble. He denies venereal diseases. He was an abstainer until two years ago, and has not partaken of alcohol to excess since. Drug addictions were not elicited.

In contradiction to the first informant's history given above, the patient stated that his first attack occurred five, and not ten, years ago, but the rest

of the data remain the same, although he thinks he remained well for over a year. The patient seemed somewhat hazy about these facts, but his wife stated positively, and he himself later corroborated it, that he has had a sleepy spell every fall, as a rule, and that the longest one lasted from September 20 to May 15, 1914. He did no work during this period, and lay in bed most of the time. He would know what was going on, would reply to questions, but would quickly drop off to sleep again. The other attacks were similar to this last one, only they did not last so many months. During his waking periods he works about twenty-two hours a day, only lying on the bed with his clothes on for an hour or two. He feels refreshed on awakening, and never feels sleepy during the day.

The patient said he could not recall ever having dreamed, and that he had no complaints of a somatic nature, except occasional "indigestion." He said his appetite is always good. He thought his memory was not quite so good as it used to be. He said he was fifty-six, but could not figure out what year he was born in. He was very willing to discuss his own condition, and hoped he might be cured, because people were saying that he was "crazy" and he feared being put away in an institution. He told the examiner privately that about the time his trouble began he had seen a neighbor—a woman—in a very excited state (possibly mania), and that this woman was always complaining of pains in the small of the back. He said he also had pains in his back about that time, and that he thought it might be sexual weakness. Of late years his wife has been sexually frigid towards him, which worried him considerably. He is not himself impotent. He also confided to the examiner that the farm is in his wife's name, and that her brothers want him to do all the work. He admitted worrying a great deal about the time his first spell came on about working for nothing, although he insisted that he is not lazy, but feels he ought to be compensated somehow for what he does. About a year ago a physician told him that the weakness in his back was due to overwork, and this explanation appealed to the patient very much. He added that he thought that must be why he needs so much sleep.

The patient presented no manifest psychotic symptoms, no delusions, hallucinations, or obsessions. He was correctly oriented for place and person, but was somewhat hazy for time, which, however, he was able to correct without aid. He showed no emotional inadequacy, no mannerisms, stereotyped attitudes, etc. He was slightly suggestible. He talked willingly and volubly about himself. His wife stated that he was stubborn at times and that one could not "fool" him. She admitted that he was trusted and well liked in the neighborhood. There was no marked sclerosis of the radial vessels; the patient seemed in sound physique; heart and lungs negative. He presented no neurologic signs, except that the left pupil was slightly irregular, but both reacted promptly to light and accommodation; a very slight and doubtful slurring on test words could be detected, and there was fairly definite, but not total, anaesthesia of the cornea and pharynx. The Wassermann test proved negative.

Naturally, a patient presenting such unusual symptoms ought to be kept under observation to determine, among other things, whether the symptoms actually exist. However, the informant in the case is

a very reliable and accurate observer, and I personally had corroboration from five others who know Y well.

Dementia præcox was first thought of, but that does not seem quite tenable; nor does a simple deterioration or even a cerebral arteriosclerosis explain the case. It is even doubtful if the patient is constitutionally inferior. I venture to suggest that the case is one of hysteria.

One can only guess at the mental mechanisms involved, but possibly because of his first marital disappointment, the fact that he lives unhappily with his second wife, who owns the farm on which he must work—as he thinks, for nothing—his long sleep states indicate a submerged wish to get away from it all, not unlike the case of hysterical blindness reported and analyzed by Ames.¹ The slight anæsthesia, his suggestibility, the appeal which the physician's explanation of overwork made upon him, may all be mentioned in support of such a view.

[*Note of April 4, 1915.*—Friends of Mr. Y write me that since my visit to him he has been a changed man. He has not “hibernated,” works regular hours during the day, and sleeps normally at night. He also now gets on well with his wife, attends social functions with her, etc. His wife and neighbors are most astonished at the patient's sudden turn for the better. He is said to have been much impressed by my visit, and believes that the taking of the blood for a Wassermann had much to do with his “cure.” Of course, I employed “waking suggestion” with as much force as I could when I saw him. These facts would tend to corroborate the diagnosis of hysteria.]

¹ T. H. Ames, “Blindness as a Wish,” *The Psycho-analytic Review*, vol. i, No. 1.

DISUSE CRIPPLINGS

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PROBABLY one of the most interesting medical conditions in modern life that many physicians have to see—and the sufferers from which usually have to see many physicians and surgeons—is what may be called, for lack of a better term, by the generic, quite non-theorizing name of disuse crippings. It is an affection particularly of those past middle life, though not infrequently seen in those of younger years, and has usually developed, according to the history, as a consequence of some accident causing a limb or a joint or a set of muscles to be put out of commission for some time or to be used much less than usual for some considerable period. As a consequence, the muscles of the part atrophy, though often not to a marked degree, from disuse, and then somehow prove incapable of being brought back to their ordinary employment again. The simple, familiar example of the affection may be seen whenever a patient suffers from a fracture of a bone or a bad sprain or an injury of almost any kind requiring rest as a part of the treatment. The inaction necessary, or supposed to be necessary, for proper repair brings on a passing atrophic condition of the muscles. In the great majority of people, and especially in those of younger years, this is perfectly capable of being overcome by appropriate exercises during the period of convalescence subsequent to actual repair. In a certain number of cases, however, the failure to regain control of the muscles and bring them back to normal nutrition and function leaves what is practically a deformity, so far as function is concerned, or what I prefer, for various reasons, to call a disuse crippling.

These crippings first came into particularly prominent attention not long after plaster-of-Paris bandages for sprains and breaks began to be rather generally used. The utter disuse of muscles which so often occurs in connection with the application and wearing for a prolonged period of a snugly-fitting plaster-of-Paris bandage, and

especially if it be a rather heavy one, very soon brings about marked atrophy of the muscles of the neighborhood of the joint of fracture or sprain. It was noted that in a certain number of these cases the rehabilitation of the muscles either did not take place properly or was incomplete, or, at least, some subsequent muscular incapacity remained and, as a consequence, there was a halt in the gait if a lower limb was involved, or an awkwardness of movement in the upper limb.

At first this was thought in most cases to be due to some definite associated injury, perhaps undetected, owing to particular circumstances in the special case. It was concluded that a nerve must have been injured or an artery pressed upon, or a vein compressed, or that the circulation must have been interfered with by some vascular disturbance either at the time of the accident or during the subsequent process of repair. In some other cases it was thought that the plaster-of-Paris dressing itself must have by pressure, particularly at the ends of the wrappings, led to some injury of nerves or some enduring disturbance of the circulation. While in a certain number of the cases some such necessary accident or incident was responsible for the subsequent crippling, in a large number of the cases it was found to be impossible to demonstrate any definite organic pathological condition. There was no existent nerve lesion and no demonstrable morbid change of any kind in the circulation. There was apparently nothing the matter, except that the muscles of the part having atrophied to some degree, it seemed to be impossible, or practically so, to bring them back to their original condition.

One of the most notable features of a number of these cases, and the one which brought them particularly to my attention, was the fact that after having gone the rounds from one physician to another, and not infrequently, be it said, from one skilled surgeon and expert orthopædist to another, practically always deriving some benefit for a time from any mode of treatment that was applied to them, yet subsequently very often lapsing back into their previous condition, not a few of them—indeed, a disturbingly large number of them—were cured by some form of irregular therapeutics, osteopathy, chiropractics, or, perhaps, by a “bonesetter” or some outlandish practitioner of some special remedial cult, or even by Christian Science, or naturotherapy, or something or other of the kind that works no physical

effect yet produces a cure in very obstinate cases. I have known two clergymen, thoroughly sensible men, one of them extremely intelligent, cured by a well-known "bonesetter" who just made one simple manipulation, "set their bone right," though there had never been any break or dislocation.

As a consequence of a single application of this simple manipulation cases that had been so obstinate to treatment as to be considered quite hopelessly intractable proceeded to get better, though a wealth of the highest professional skill and expert scientific treatment of all kinds, medical and surgical, had been applied to them in vain. I have known a rather distinguished professor of a more than conventional small college receive the greatest possible benefit in a case of distinct crippling after a muscular wrench from a series of treatments by an osteopath, mainly directed to the correction of a supposed subluxation of his vertebræ. My professional friend was quite enthusiastic about the wonderful new discovery that explains all the ills of men, and a few more besides, which Dr. Still, the inventor of osteopathy, calmly asserted, in a little controversy that I once had with him in a popular magazine, was responsible for ninety-five per cent. of all the ailments of mankind; that is, not only the muscular and nervous but also the organic ailments, the affections of the heart, liver, kidneys, bowels, stomach, and even the lungs and blood-making organs, as well as all the infectious diseases. The much-explaining lesion is quite impossible of discovery on the cadaver, but I need scarcely say that it is a mental lesion of the greatest possible significance to osteopaths.

Besides these surprising cures of obstinate cases in our own time, I have been very much interested in the historical accounts of cripples of various kinds and their cures. For a number of recently past centuries in every generation of which we have sufficient medical records there has been some prominent new method of treating patients by which cripples or those who used certain members and groups of muscles with a great deal of difficulty and marked discomfort were cured after having tried in vain all the resources of the regular medical profession. Men threw away their crutches and their canes or left them with their benefactors as memorials of the cures that they had worked. When Charles I, in England, was put to death and there was no one to touch for the various ills that used to be cured

by the king's touch, an Irish adventurer, Greatrakes, a soldier out of a job for the moment, announced that he had been divinely inspired by identical dreams on three successive nights to touch and cure the people. He *touched* them very effectively, so far as getting money out of them was concerned, and, in a modern phrase, his generation was certainly done good by him. The cures of his that attracted attention were particularly those of chronic pains and aches of all kinds, though not a few people were able to throw away crutches and canes that they had used sometimes for years, though their affections had been under the treatment of some of the most distinguished physicians of the time. As this was just before Sydenham's day, and, as I have shown in some articles on the physicians of the time, their knowledge of medicine was by no means to be despised, these cures are just as surprising and need an explanation just as much as those of the irregulars in our time.

In the next century a series of similar cures was worked by Father Maximilian Hell, who used magnets in order to produce them, or rather to bring them about. The magnets, of course, had no influence of any physical kind, and yet they were the instrument of the cure. The magnets were made in different shapes, according to the portion of the body that was to be acted upon, and sometimes even in the shape of internal organs, when these were to be treated or the affection was attributed to them. Pains in the back, for instance, were treated by the application of a double magnet, made in the shape of two kidneys, with a cross-piece connecting them. It is easy to understand how much of influence on the minds of patients shaped magnets in all these peculiar forms would have, especially when it was a great scientist who was applying them, well known as a teacher of physics and astronomy, and when it was perfectly clear that his only idea was the benefit of the ailing. Many of the patients had been bent over and were so crippled as to be quite unable to work before the "cure" began.

Mesmer saw these cures of Father Hell while he was at Vienna, and he proceeded to treat patients in similar fashion. Besides the magnets, however, he used also what he called a *bacquet* or battery, a series of bottles filled with metallic particles and connected together by means of wires, in circuit with which patients were placed. The apparatus was somewhat like a battery of Leyden jars, and the

translation of his word would undoubtedly be battery, but a committee of a French Academy of Sciences appointed for that purpose, one of whom, by the way, was our own Franklin, who was just then in Paris as Ambassador from this country, declared that there was not the slightest trace of electricity or magnetism or any other physical force that they could detect in "Mesmer's battery."

In spite of the fact that Mesmer's name has become attached to what used to be known as animal magnetism and, we now think, of hypnotism, Mesmer never produced the hypnotic sleep, which was not used until his disciple, or, at least, follower, De Puysegur, employed it. Mesmer's effects were supposed to be electromagnetic, just as Father Hell's had been, but there was no doubt at all about the number of cases of persistent acquired deformity that he cured, nor the apparent miracles of healing of cripples that he worked. Many hundreds of people who had been treated in vain by prominent French physicians of his time went to Mesmer and were improved and some of them cured. Not a few of them were able to abandon the use of crutches and canes and various appliances that they had been compelled to use for a considerable period. He was looked upon literally as almost a miracle worker in his power to cure chronic crippling affections, the sufferers from which had practically given up hope of ever being cured, and many of whom had tried almost every known form of treatment in their time.

Another man who saw Father Hell's wonderful cures at Vienna also followed him in his therapeutic experiences and successes, though changing his methods; for, while Mesmer wandered off into supposed electrical applications, Pastor Gassner (or *Pfarrer* Gassner), of Elwangen, gradually abandoned the use of the magnets and came to depend entirely on mental influence or, as he was inclined to think it, spiritual influence. He saw that, while under Father Hell's care, the application of magnetized metals shaped like organs brought cures, but then he demonstrated that the same metals, even if they were not magnetized, produced similar startling cures. Further experiences showed very clearly that the "cures" would come without these metallic applications when patients were deeply under the influence of the healer. *Pfarrer* Gassner declared, after trying to solve the mystery of these observations, that the ills of mankind came from the devil, and God was responsible only for good. Any one

who abandoned the service of the devil and turned with confidence to God then would surely be cured. It was an anticipated paraphrase of the Christian Science declaration that there is no evil in the world, because God creates only good, but, unfortunately, mortal mind creates the idea of evil and then suffers from it. The number of people, many of them cripples of long standing, who flocked to Elwangen and were *cured* was very large. Many left their crutches behind them. After a time Father Gassner's teachings and practices were condemned by the Church, and his therapeutic efforts were at an end. To many people at that time this seemed an arbitrary exercise of authority quite unjustified, for the number of people who had been *cured* was literally legion. Always the cures were particularly of chronic cases, sufferers from pains and aches and disabilities, most of whom had been treated in vain by regular physicians.

It was this same class of cases that was cured by Perkins with his tractors, and a similar group by St. John Long and his famous liniment. The liniment worked so many wonders of healing in chronic hopeless cases, and apparently so many miracles of recovery occurred among those who had been crippled, that the English Parliament was practically forced by public opinion to pay a large sum for the mysterious secret of this charlatan St. John Long, who was found afterwards to have been a convicted felon and who was, with some justification at least, suspected of several murders. His remedy had been discovered, so he claimed, after long years of the study of various means of healing, and the invention of his liniment was the result of practically exhausting all the known sources of therapeutics. It proved, when the secret was bought by the government, that it was with a turpentine liniment made up with egg instead of oil that all these marvellous cures had been worked. It ceased to cure after this; it had lost its most powerful ingredient—the influence upon the mind exerted by its secrecy. So striking was this immediate falling off in efficacy that it was even suggested for a time that St. John Long had really deceived the government and had not really betrayed his secret, in spite of the large sum of money paid him. The liniment before and after, however, was made up in just the same way and was in the British Pharmacopœia for many years.

The various improvements in electrical machines, from the Leyden jar down through the Wimshurst and the high-frequency current and all the rest, have each in their turn worked wonders with regard to a large number of these chronic cases. It is amusing to read the account of the wonders worked by the Leyden jar when that electrical invention was novel and was scarcely more than a toy in size, yet cured and produced symptoms of all kinds. Priestley, the discoverer of oxygen, has told the story of it in his history of electricity, published about 1770. An electrotherapeutic journal published about 1800 gives a list of cures quite as numerous as any that have been obtained by subsequent developments of electrical machines. Indeed, that electrotherapeutic journal ought to be reprinted in order to show how much promise and potency there was in electricity in those days when they knew so little about it. Galvani and Volta's discoveries had led very generally to the thought that electrical energy represented one phase of vital force, and it is easy to understand how much patients were influenced by this thought and by this new method of treatment, which actually gave them back some of the vital energy that they had lost. Atrophic muscles particularly were renewed in this way better than any other.

To come down to our own time, it must not be forgotten that a modern phase of interest in hypnotism and its influence on disease was precipitated by the observed cure, by means of hypnotism, of a case of sciatica with crippling, which was brought to Bernheim's attention at Nancy. He had tried by every means in his power to cure this case of sciatica, involving considerable disability, but without success. He knew that the case had been under the treatment of others with similar failure, though all sorts of methods of treatment had been employed. When, then, the patient was treated with hypnotism by Liebault for some time and was not only greatly improved, but actually cured of his discomfort and disability, Bernheim's attention was attracted to this method, and as a consequence the clinic at Nancy took up the study and the practice of hypnotism. Bernheim himself became the protagonist of the movement which proclaimed hypnotism as a new therapeutic agent capable of developing a wonderful force for good. The Nancy experiences led for some ten years to the devotion of more attention to hypnotism by serious medical teachers than had ever before been given.

Almost needless to say, hypnotism has now been relegated to deserved neglect. No serious physician attempts to use it for anything, unless occasionally and for a very few *séances* in the treatment of psychasthenic disturbances or for the lessening of dreads and the like. It must not be forgotten, however, that when it achieved its modern popularity it was apparently curing all sorts of physical ills. It is interesting, for instance, to realize that in England, when the first news of the use of ether in America to produce anæsthesia reached Britain for publication in the English medical journals, those medical journals were engaged in an absorbing discussion of the employment of hypnotism as an anæsthetic in surgical operations. It had been so employed successfully in India by Esdaile in a large number of cases. It was because of its physical effects that it seemed valuable. In the relaxation of cramped muscles and of such tension in atrophic or disused muscles as made it apparently impossible for patients to employ them properly it was particularly valuable. This is what gave it its vogue. The cure of more purely psychic symptoms would not have attracted nearly so much attention, but the relief of physical pain and physical disturbance made it seem certain that there was some marvellous new agent at work in the use of hypnotic influence.

In our own time there are many other manifestations of this same tendency for these crippled cases to be cured by means that have no physical effect, yet succeed in producing cures where many physicians have failed. A large number of those who were cured by Alexander Dowie, the prophet of the new religion, who proclaimed himself Elijah returned to earth, were of this class. Many of them gave up the use of crutches and canes after having carried them for years. These people were so firmly convinced of Dowie's power to heal that these miracles of healing became for them absolutely incontestable evidence of the divine mission of the new prophet. They were perfectly willing not only to follow him but to give that highest tribute to their belief in his miraculous power, the surrender to him of the control of their money. He claimed to have cured 100,000 people. Many hundreds at least, probably many thousands, of these were cripples of various kinds who, as the result of Dowie's "healing touch," were able to walk straight again and regain former strength. Nor were these cures merely imaginary or fictitious. They were quite

real. There had been disuse of muscles and there was pain on using them, and physicians had been unable to help the patients, and now they were able to walk once more.

At all times, from Egypt and Babylon down the ages, there have been crutches to hang in shrines or waxen images of cured limbs that were left as exhibits beside the altars or in the rooms of healers of all kinds or that were shown as demonstrations of their curative power by prophets and seers and remedy venders of every description. Very often the people who had used the crutches had previously consulted many physicians and not been cured and then were completely healed and were able to give up their crutches or orthopædic apparatus of one kind or another at the behest of these healers. The explanation of these "cures" that are common in the history of the race for four thousand years represents also the explanation of the success of the quacks and charlatans and healing methods of a number of kinds, Eddystic, manipulative, naturopathic, psychopathic, psychologic, by seer power or seventh son force or bonesetting heredity so common in our time. What is necessary is to eliminate the cases in which there is some real physical deformity from those in which a mental inhibition is the cause of the lack of power in the crippled limbs.

There can be but one conclusion from all these observations of cures, historical and actual, by remedial measures supposed to be physical, yet proving eventually to have no physical efficiency: that is, that the change in the mental state of the patients was the eminently curative factor. Other indirect elements in it were the encouragement to get out into the air more, with the consequent improvement of appetite and sleep, and, in connection with them, of every other physical function of the body. From the consideration of these cures it is quite possible to argue back and trace what were the real causes of the conditions that were cured and just why it was that remedies of all kinds employed for them failed to produce the desired effect until some mode of treatment came that brought with it a distinct change in the attitude of mind toward themselves and their ailments, a belief in the possibility of cure and a determination to use the affected muscles as if they were cured, with consequent relief of symptoms and gradual restoration of the nutrition and function of the part.

What happens with a great many people because of an injury or

interference with the use of muscles by a firm bandage or plaster cast for any considerable time is that they first get out of the habit of using muscles and then become afraid to use them. There is only one way to strengthen muscles, especially when they are weak, and that is by exercise. Children have the task imposed on them of exercising their muscles so as to aid in their growth. Fortunately they have no consciousness, in any morbid sense, of the significance of muscle pains and aches, and, as a consequence, they go right on exercising them in spite of the discomfort occasioned by the exercise or the sensations of stiffness that occur when rest is taken after severe exercise.

It is quite impossible to develop muscles by exercise without making them sore and achy and painful. If a person who is unused to walking walks three or four miles, muscles become quite stiff and sore, both to the touch and to movement. Whenever muscles infrequently used are employed to any extent there is distinct localized soreness in them next day. When a man unused to horseback riding rides even a few miles his adductor muscles are so sore that he walks rather awkwardly next day, and it is difficult for him to assume a number of positions. I once went through the Mammoth Cave in Kentucky with a group of people, and, as the time of the party was limited, we were taken through a much longer route than is usually assigned to the first day's exploration. A good deal of the travel through Mammoth Cave is up and down. All of it is extremely interesting, and, as a consequence, people walk much farther and make much more exertion than they have any idea of. Some of the walking is through rather tortuous passages, up and down, requiring the use of muscles that, especially, the city dweller, who uses elevators and doesn't go up and down stairs much, brings very little into play, some of the muscles, indeed, not being used in ordinary life at all. As a physician I was given the confidences of the party with regard to their feelings next day. I could sympathize thoroughly with them, because I had most of them myself. The muscles of the anterior portions of the thigh, particularly, and of its inner aspect, were distinctly sore to the touch, were very stiff and tender when used, and most of us were exhibiting a marked tendency to go around on our toes rather than the heel and toe of the ordinary walk.

Some of these people were quite sure that they had caught cold

in the draughty cave and were now suffering from rheumatism or some such serious constitutional condition. I am quite sure, from that experience, that a good many people, especially those of very sedentary, inactive lives, who are tempted to go through the Mammoth Cave are subsequently treated for rheumatism, when absolutely the only condition present is the sore and achy tiredness of muscles that had not been used before to the same extent. The soreness lasted for the better part of a week, and, indeed, was still felt distinctly even a full week later on coming downstairs in the early morning, though later in the day there was no manifestation of this.

I once had to care for a patient who had been struck by an express train and not killed, though pretty badly injured. He was taken aboard the baggage car and was to be carried to a railroad hospital which was distant about an hour's journey. A little artery was spurting, and, as I had no instrument case with me, I was compelled to prevent bleeding by pressure. This required me to stay close beside the patient, and, without quite realizing it, in my interest in the case I assumed a squatting position, sitting on my "hunkers," as it is sometimes familiarly called, for more than half an hour, when, finally, a box was provided for me on which to sit. In the meantime the train was making even better headway than usual over a roadbed not too good at the best, and at this point rather noted for its curves and grades. The door of the baggage car was open, and, though it was the summer time, a rather brisk breeze was blowing through the car that was cold enough to make one shiver at times. I was quite sure, when I woke the next morning, that I had the beginning of a serious attack of rheumatism. Every muscle in my body ached, particularly all those in my legs and back. It was fully a week before this soreness and tenderness disappeared. For three nights I woke up every night with muscle pain due to the painful effort required to turn over in bed. There was never any temperature, however, and during the course of the first day I realized that it was the unusual use of muscles; above all, the rather strenuous exertion and exercise of supporting a body that weighs 250 pounds, which a number of muscles unaccustomed to such usage had to undergo in order to maintain equilibrium, in what was, after all, a rather unstable position, under pretty difficult circumstances, in the rapidly-going, jolting train.

Those who want to learn to ride horseback, however, or to play games hard, know that, in spite of muscle soreness, they simply must go on and use their muscles. *They must push through.* A man who is sore after three miles of walking soon learns, by exercising his muscles, to walk four or five or six miles without noticing it very much. The first day of the oarsman at the oars, if he rows for any distance, makes every muscle in arms and shoulder and back and many of those in the legs sore and tender. If he were to complain and ask to be treated for this soreness and were to rest these muscles until the soreness left, he would have to repeat his exercise *ad infinitum*. He would never succeed in hardening his muscles to their work. The next day the oarsman gets over his stiffness by exercising all his muscles a little more, and repeating on the third day, taking an occasional rest, but never resting until all the soreness is out. In this way, after a time, he can accomplish what made him so sore the first day without noticing it at all. The walker, the football player, all of them can and must do the same thing.

The first day's skating every winter brings to the skater vivid reminiscences of the very first morning after his very first day's skate, when, as a rule, almost without exception, he was quite sure that skating was an exercise in which he could never have any pleasure, since it made him so sore in unaccustomed places as to make walking, particularly walking up and down stairs, quite uncomfortable, and made such things as sitting with the legs crossed or sitting on a rocking-chair almost impossible because of the discomfort occasioned. When he was learning to skate, however, he kept right on trying day after day, taking the soreness and stiffness out by exercise until he has gradually strengthened muscles. It is not long before a couple of hours' fast skating becomes a pleasure and a satisfaction and brings no achy tiredness. The memory of the original tired incidents is forgotten. Sometimes people have never gone through them. It is well to recall them whenever people complain of achy tiredness in their muscles and are prone to think of it as a constitutional condition, rheumatic or the like, when it is only muscular, quite natural, and a sign of nature's power to react so as to strengthen muscles and make them available for such movements without any discomfort being attached to them.

When people are asked to restore muscles to activity which have

been lying idle for some time and which have become more or less atrophied from disuse, feelings of discomfort occur in them similar to those noted when indulging in unusual muscle exercise. There is only one thing to do for this, and that is to push through, to go on using the muscles in spite of the discomfort, with a certain amount of prudence, of course, and yet with constant, frequently-repeated daily efforts. There is no other way to build up the function of the disused muscles than this, just as there was no other way for the child originally to learn to use its muscles and increase their size and nutrition than by producing this achy tiredness in them, and no way to learn to use the muscles required in various sports and exercises other than by pushing through the discomfort and achy tiredness of each day until the muscles are hardened and developed so that there is no difficulty about using them. There is no royal road to the development of muscle except through exercise of it, and that always involves pain, stiffness, discomfort, soreness, and tenderness. It is these feelings that the older people refuse to push through or that are misunderstood by their physicians and treated by them as symptoms of disease and perhaps relieved by that falsest of remedies, rest.

Unfortunately, older people, particularly, find it very hard to redevelop their muscles in this way. The soreness and tenderness seem to them to be so great that they cannot think that they are natural, but that they must be abnormal and then they stop using the muscles. Not only that, but they put a strong brake of inhibition on the use of them, and, as a consequence, gradually get accustomed to using neighboring groups of muscles in an awkward, inefficient, and crippled sort of way, but so that they enable them to accomplish their purposes, though ineptly. The disused group of atrophic muscles then is likely to be left almost unused, or at most is very little exercised. As a consequence, they remain in their atrophic condition. As time goes on the individuals become more and more unaccustomed to using these muscles, and there is a strong inhibition to the sending down of impulses to them. This further disturbs their trophic condition and leaves them with a lack of full vital connection with the central nervous system. Some of this is, perhaps, theoretical, but over and over again I have seen it exemplified so clearly that it seems to me a very concrete observation and not merely a theory.

Sometimes, unfortunately, these patients, when their first efforts

to use their muscles bring on the achy soreness and tiredness and tenderness, are told that this represents a rheumatic or that other precious word of marvellously wide significance, a *neutritic* condition. They are told that rheumatism has developed, and perhaps their own personal experience as to rheumatism is carefully revived by the physician and, above all, any question of family inheritance in the matter insisted on. There are very few people whose fathers and mothers, if they lived to a good age, did not suffer from something that was at least called rheumatism, and so a rheumatic family history is obtained. Their tired soreness is then treated by coal-tar drugs, especially by some of the salicylates or, in our time, by the newest-fangled of all the coal-tars, aspirin, but the idea of keeping their muscles at rest is dwelt upon for them. The barrier of inhibition is strongly raised, and after this the habit of not using the muscles becomes more marked and it will be very difficult at any time to get these patients to push through and exercise their muscles, in spite of pain and discomfort, until they are back to normal conditions.

I have seen cases where a comparatively slight injury to the knee led to considerable disuse and limping and an atrophic condition of muscles, with the difference of over an inch in the diameter of the thigh, in which the only reason that apparently would account for it was that the patients had acquired the habit of sparing certain muscles during the time that the soreness continued. It is a familiar experience to find that patients who have suffered from the nipping of a cartilage in the knee-joint get to walk with a halt in that limb and spare the muscles of it until their wear on the shoe of that foot is much less than in that of the other. In the old days when dentists ran their dental engines by foot-power many of them acquired a halt in their gait, a distinct difference in the way that they used their legs, which was well recognized by the profession and came to be known as "dentists' halt." This did not develop in every one, but usually only in those of not very strong muscle build, and especially those who, with rather weak muscular systems, were above the average in weight. The halt occurred not in the leg which was used for power purposes, as might naturally be expected, but in the one on which they stood, usually, therefore, the left. Some dentists escaped the derangement by using the legs alternately. It was actually in the leg whose muscles

were not used that weakness and even, after a time, some pain and discomfort developed.

An interesting feature of these cases where muscles are undeveloped is that in such atrophic muscles tendencies to muscle soreness of various kinds in the muscles that are thus left unexercised are very outspoken, and any use of them in rainy weather is likely to be followed by considerable discomfort. Apparently their state of undernutrition makes them more subject to nervous sensitiveness. Besides, there is usually a lack of circulation in these unused muscles or not fully used muscles, and this adds to the sensitiveness of nerves. A very common complaint is that they suffer more from cold than other parts of the body, especially than the other limb, if the condition is in a limb, or that the affected member perspires more easily and is often said to be subject to "cold sweats," which is only another phase of the supersensitiveness that has developed in them.

In a word, this whole question of disuse crippling becomes very interesting from the standpoint of the influence of the mind on the conditions. There is no doubt that many of these cases occur for which apparently no ordinary medical or surgical treatment proves efficient. On the other hand, there are a great many of them for which, after all sorts of internal and external treatment have been devised without success, some remedial mode that has no physical influence of any kind at all proves successful in giving them back power over the muscles which have been a long time lamed. These are the cases that make the reputations of all sorts of new-fangled methods of treatment which come and go. They are oftenest seen in the old. It is the successful treatment of these, especially when they happen to be members of legislatures or men of political influence, that brings up the question of legislative endorsement of the new-fangled method of treatment, with full permission for its disciples and advocates to treat all classes of disease, because they have succeeded in curing some chronic ailment of more or less crippling character either in a legislator or a judge or a politician or some of the friends and relatives of such men.

Such cases make the reputations of the hereditary bonesetters and the various forms of manipulative therapy. The patients must be told, above all, that they have had something quite serious the matter with them, and something must be done to them to make them

feel that now this pathological condition has passed for good and all. So soon as that persuasion comes they take down the bars of inhibition which have prevented them from using these muscles properly, and, in spite of certain pains and aches which occur, they push on to exercise and develop these muscles. When similar pains and aches occurred before they were quite sure that they represented serious pathologic conditions which would surely increase unless cared for, and which it might be serious to provoke by any further muscular exercise. Now they know that the tingling, achy, tired feeling which they have is only a symptom of the new life which is stealing into their muscles under the new mode of treatment. This persuasion is literally true, only they could have had it at any time if they had only had the courage to exercise the muscles in spite of their pains and aches. They go on then to be cured and announce themselves as interesting examples of the wonder-working effect of the new mode of treatment. It has treated their minds, not their bodies, though it would be very hard to persuade them of this. Only when the whole series of these cases as cured in the history of medicine is viewed together does the real secret of what cures them become manifest. At the same time, the mystery of these disuse crippings is solved. Whenever a definitely localized physical pathologic condition cannot be discovered—and this is rather often the case—then the mental pathology of these cases should be considered, and it will often furnish a clue not only to their etiology but to their successful therapeutics after many forms of treatment and many hands have failed.

TYPHOID AND THE PSYCHOSES*

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It is not the purpose of the writer to dwell at length upon a subject ably discussed elsewhere, but rather to briefly set forth the salient points of a condition, the malign influence of which has undoubtedly been felt throughout the ages.

The pages of history portray that, while fevers with delirium have been observed from the days of antiquity, the writings of Hippocrates and Galen do not seem to indicate that any particular form was recognized as a distinct identity, but as merely a different expression of the same disease.

The decrease in the plagues which visited Rome after the introduction of a water supply and drainage system suggests that some of the epidemics might have been typhoid, as the disease termed "hemitritæus" embraced many of the phenomena characteristic of this state. From a modern viewpoint, however, there seems to be little doubt as to the identity of the malady described by Willis in the early part of the seventeenth century, while it remained for Huxham of Plymouth, in the next decade, to draw the line of distinction between the so-called "slow nervous" or typhoid and the "malignant petechial" fever, typhus. Early in the nineteenth century Murchison first suggested the possibility of contagion by feces, but, as much stress was laid on impure air and sewer gas as sources of infection, it fell on Budd of Bristol, in 1856, to establish the first tangible view on the matter, viz., that the disease always sprang from some specific source. In 1880 Eberth discovered the germ, while in 1895 the agglutination reaction was first brought into practical application by Widal.

In reference to typhoid Osler writes: "Of no other disease can we read so full a history from American sources alone." But by this statement we must not infer that the ravages of this malady are

* Written for the Clinical Society at the Government Hospital for the Insane, Washington, D. C.

mainly exerted within our own confines; for statistics prove that it is most widespread in its scope. No country or race is immune. We read of its occurrence in the far north and south latitudes, in the mountains and at the sea level, in the cities and in the country, and, in fact, any place existing under improper sanitary conditions. Insidious in its mode of travel, it does not extend over an entire continent or strike the majority of those exposed, but manifests itself by epidemics scattered throughout the various portions of the land; an infected city may spread the disease throughout the country, while from the country comes a stream of infected people to the city.

For some reason, not entirely clear, the disease is more prevalent during the autumn months, but in this country no season is without a few cases. It may be, as quoted from one writer, that during the hot and dry season, when the ground water is low, the sources of supply are likely to drain a wider area, while again in the summer months, when flies and other insects are prevalent, there is not only an increased liability to infection from this source, but from the particles of dust which are blown about in the air, and which may contain the germ.

Treating further on the subject, Flexner says: "Typhoid is a protean disease when considered from its chemical, its pathologic, and its bacteriologic aspects." Although most frequently observed during young adult life, it has been noted during early childhood, and is not uncommon in old age. Run-down conditions play little part in the etiology, for it is observed in those who prior to the onset enjoyed robust health; while some maintain that a deficiency of the gastric juice may cause the stomach to act as a suitable culture media, there is no direct evidence to prove that the bacilli are actually killed by the fluid, yet it is quite evident that the life cycle is vitally affected by the varying chemical constituents of the body, as observed by the growth of the germ on fæces of different chemical components, subject, of course, to atmospheric variations. This may also account for the difference in severity of the individual attack.

If one would attempt a classical outline of the course and duration of typhoid, he might quote Dieulafoy and say that normally the disease is characterized by three stages—ascending, stationary, and descending—these being preceded by a period lasting from a few days to two weeks, which by some authors is termed the prodrome.

Jaccound, however, includes this under the period of ascent, which he calls the stage of invasion, while the period of decline is considered as the stage of repair. These divisions, while convenient for description, are not in all cases clearly marked clinically, for in some the prodrome may be entirely absent, and the disease be ushered in by a chill, the typical symptoms and localized signs of lobar pneumonia for a time completely disguising the true underlying condition. Again, dyspeptic or intestinal trouble may open the scene and the case be mistaken for one of appendicitis, while a sudden shock from perforation of the bowel, with the manifestations of hemorrhage or peritonitis, may be the first intimation of the existence of the trouble. Again, in children it often lies hidden beneath the illuding cloak of diphtheria or whooping-cough. Flexner truly summed up the situation when he termed enteric fever a protean disease.

Discussing the subject of temperature, Wood, in a recent article, reminds us that, while lysis has for many years been considered as the characteristic termination, a fall by crisis would suggest error in diagnosis. Nevertheless, Jaccound, Curschmann, and others have observed this phenomenon at the fastigium, which the latter called the pseudocollapse, and which was unattended by any alteration in the pulse. Wood cites six cases of this nature, one of which showed a drop from 103 to 97.6 in nine hours, with a favorable effect on the pulse and no effect on the respiration. Another point which may be of interest is that while in typical cases acceleration of temperature occurs in the evening, followed by the characteristic morning remission, the reverse may be noted in those who prior to the onset had been accustomed to work at night, while a patient who comes to the hospital with scarcely any temperature at all may, on being placed in bed, show, after a few hours, a rise of three or four degrees. Although the pulse may give no characteristic findings, it is, in the early stages of the disease, much slower than would be expected in comparison with the height of the fever. There is, according to McCrea, no disease in which the dicrotic, or apparently double pulse, is so prominent as in typhoid. This, he claims, is undoubtedly due to alterations in the thermic centres of the brain, reduction in arterial tension from vasomotor paralysis, together with degenerative changes in the heart ganglion. It may be well to remember, therefore, that

an increase in the pulse, together with a steadily falling blood-pressure, is of grave omen, while sudden death has occurred from acute dilatation due to myocardial degeneration.

A mere mention of the less common forms will suffice here, as this portion of the subject has been ably discussed elsewhere. However, aside from the mild and *ambulatory* types which are not exempt from perforation or hemorrhage, we have the *abortive* type, a term applied to the short duration rather than the benign nature of the trouble; the *sudoral*, characterized by paroxysms of temperature, followed by drenching sweats, which phenomena may occur several times within twenty-four hours; next the *hemorrhagic*, with bleeding from the nose, lungs, gums, etc.; the *adynamic* form, with lasting stupor, fœtor of the breath and sweat, with a tendency to gangrene; and, last, the *ataxic* form, showing violent delirium, cramps, lumbar pains, *subsultus tendinus*, and convulsions, the most fatal form of typhoid.

Various authors claim that the Gruber-Widal test is best done with high dilutions, a reaction being demanded within a certain time. This feature is much more pronounced during the early stages of the disease, while later in the course the reverse is the rule. In explanation of this, Sahli claims that, in addition to the agglutinating property of the serum, there is, early in the course, a counteracting agent which may be overcome by more marked dilutions. He maintains, therefore, that a negative Widal should never be assumed merely because the reaction is not given by a concentrated serum. It must also be remembered that, although the Widal is usually obtained during the early stages of the attack, it may not appear until convalescence is well advanced, or even at the date of discharge, and, while it may disappear within a few weeks after the recession of the fever, it usually persists for about four or five months, and cases are recorded wherein the reaction was obtained two years after all signs of the disease had vanished. It would appear, therefore, that in order to make a definite diagnosis of typhoid a blood culture should be done in connection with the agglutination test. Again, Sahli reminds us that considerable confusion has arisen through the creation of the pathologic conception of paratyphoid, a term applied to a condition which, though not differing clinically from the true form, is uniformly less severe, and in which the Widal

reaction with typhoid bacilli is negative. He believes that both, however, are merely different varieties of the same species, the result of natural selection, because the typhoid bacilli can assume different characteristics, depending upon the varying chemical susceptibility of the living body, for within certain limits of dilution the typhoid germ is agglutinated by the paratyphoid serum, and *vice versa*.

The works of various authors seem to indicate that, although the immediate effect of vaccination is to diminish the resistance to infection, it at the same time produces a marked increase in the bactericidal and agglutinating properties of the blood; and, although the protection conferred by it persists for about two years, in view of the temporary lowering of resistance it is not well to vaccinate during an epidemic.

Having reviewed the subject from the clinical side, the opportune moment has arrived for a consideration of the disease in its relation to abnormal mental states. Although the psychoses associated with typhoid are, as a rule, distinct among other forms of mental aberration, being classed usually under the infection-exhaustion group, there are, nevertheless, many features observed in connection with these deliriod states which may be of vital importance not only as regards prognosis but from the fact that in some cases the true underlying condition has been successfully, though temporarily, concealed.

Esquirol, towards the end of the eighteenth century, called attention to the relationship of the febrile processes to abnormalities in the psychic sphere, and, although opposing views have arisen since his time, the recognition of this fact is becoming more widespread with the advancement of science.

Freidlander, in reference to the subject, writes, "There is a unanimity of opinion that, of all acute diseases, typhoid is the one most accompanied by mental symptoms." I think, however, that in order to verify this conclusion it may be well to briefly review the classification of psychic phenomena observed in connection with typhoid as set forth by Kraepelin. It is interesting, however, to remember that individual and racial characteristics are very influential factors from not only an etiologic but a prognostic point of view; this is clearly portrayed in the remarkable susceptibility of the negro, as in other forms of psychoses, to acute deliriod states.

As mentioned in a previous paragraph, while enteric fever has

been known to lurk beneath the cover of some other physical malady, an example of which may be cited in the so-called meningotyphoid, so the initial or prefebrile delirium may for a period so successfully veil the true underlying condition as to cause serious error in diagnosis. Cases have been admitted to institutions for the insane which were thought to be suffering from delirium tremens, manic-depressive or undifferentiated psychosis, while, on the other hand, the typhoid state, the sequel of profound intoxication, may simulate a case of catatonic dementia præcox. This is not surprising, however, when we consider that in many of these cases there is no temperature rise, and that often the first intimation of the existence of the disease is a sudden shock from intestinal hemorrhage or perforation of the bowel.

The occurrence of delirium, therefore, in a patient, no matter under what circumstances it may be found, is always a grave prognostic omen, as it is in almost every case a positive sign of diminished cerebral resistance.

CASE A.—The patient, a man of thirty-two, had been in excellent physical and mental health. He always earned a good living, was of a jovial disposition, and fond of outdoor sports. He was temperate in his habits, but owing to business affairs he had been very irregular in his diet. He was admitted to this hospital on a medical certificate which stated that the patient was markedly retarded, but that he at times became excited and destructive. On admission he was talkative, showed flight of ideas, with a tendency to rhyme. There were distractibility, hypermotor activity, and visual hallucinations; he was disoriented in all spheres, and in a very emaciated physical condition. His temperature was subnormal. After about two weeks in the hospital his hallucinations became very pronounced in the visual, auditory, and tactile fields; he became more confused, and his physical condition grew worse. About the beginning of the third week he suffered a slight hemorrhage from the bowels, followed shortly by another, which was more severe, losing almost a pint of blood. The Widal reaction taken at that time proved positive. Although he had several slight hemorrhages after that, he eventually made a good recovery. However, for several months he was quite retarded, and had an amnesia for certain events which had transpired during his illness. He also experienced considerable difficulty in remembering dates, "a feature which," according to McCrea, "is quite noticeable in typhoid." The case was diagnosed as "exhaustion psychosis," and in view of the reduction noted in the psychic sphere at the time he left the hospital it was thought that the mental disturbance might mark the beginning of a præcox process.

CASE B.—Parents were formerly inmates of this hospital. Patient had been a healthy and intelligent girl until shortly after the birth of her first child. The medical certificate stated that she imagined she was being poisoned. On

admission she was in a delirious state, talked constantly about her family. Physical examination showed she was poorly nourished, the reflexes were exaggerated. On the seventh day after admission the signs and symptoms of typhoid became manifest: the Widal was positive and blood culture showed the germ. There was marked subcutaneous tenderness and retraction of the head; she developed a severe furunculosis, grew gradually weaker, and died after a three weeks' sojourn in the institution.

Some writers have claimed that if a patient suffering from mental trouble goes through an attack of typhoid a beneficial effect upon the psychosis may be noted, one English author reporting twenty-one cases of complete recovery. It would appear, however, that an infecting agent powerful enough to produce such morbid psychic phenomena as observed in typhoid conditions, viz., initial delirium, febrile and asthenic psychoses, is in all probability able to go a step farther, and in some cases leave in its wake the stigmata of permanent organic change—dementia.

CASE C.—A synopsis of the record shows that one paternal uncle had always been considered peculiar. One sister committed suicide owing to worry over heart trouble. The patient was a healthy, normal boy until he reached the second year in high school, at which time he suffered a fall from a horizontal bar, and was unconscious for some minutes. He recovered, however, and no injurious effects were noted. About fifteen days later he fainted and was put to bed. The physician being summoned diagnosed the case as typhoid fever. The patient was in bed for six months, and during the height of the attack was in a delirious condition. He apparently recovered and returned to school. He was obliged to desist, however, as he would have a sick spell about once a week. He tried work, but could not get along. He grew careless and would not change his clothes. Finally he attempted violence on a member of the family and was sent here, after having been in several sanitariums. At the present time his mentality is markedly reduced, and he sits all day in a chair, staring vacantly at the floor. He never speaks, but at times nods a reply to questions.

CASE D.—Patient was a healthy boy until twenty years of age, when he had typhoid fever, following which he was sent to this institution. The conflicting statements which he made in the history show evidence of memory defect, especially for dates. He could not tell why he was sent here, except that he was picked up on the street, because, for some reason which he could not explain, he began to run around in an aimless manner. This was shortly after the attack of typhoid. At present he is irritable, occasionally shows mannerisms, and is inclined to be moody. There is a lack of moral tone. He is well oriented at present, but still has some difficulty in remembering dates.

The last case which I shall report is of interest not only from the possibility of error in diagnosis, but it may serve to bear out the

theories in regard to the persistence of the agglutinating properties in the serum for long periods after an attack of typhoid or the administration of prophylactic vaccine.

CASE E.—The patient, a young soldier, gave a very unreliable history. It was ascertained, however, that he had typhoid fever in 1902. He enlisted in the army in 1908, and served in the Philippines. At the expiration of his term he again enlisted and was sent to China. Although there is no record of his having been vaccinated while in the Orient, he told the army surgeon and his attending physician that on one occasion while in the East his arm was punctured. On admission here he showed considerable dilapidation of thought, was disoriented, suffered from auditory hallucinations, and gave voice to many absurd and fantastic delusions. He has shown little improvement since he came, and spends most of the day sitting on a bench, staring vacantly at the floor. In the early part of October it was noticed that the patient was not eating well. He appeared to be in a stupor, and was placed in bed in one of the hospital wards. Within a few days the temperature showed a gradual step-like rise, reaching a maximum of 103.3° on the thirteenth day. The Widal reaction was strongly positive. The pulse ran about 80 per minute, the swiftest record being 114. It was dicrotic in character. The spleen was slightly enlarged, there was slight tenderness over the gall-bladder, the bowels were constipated, so much so as to require an enema of a cathartic almost every day throughout the illness. The tongue was dry and brown, and the abdomen was tender and tympanitic. The patient suffered from occipital and frontal headache, presenting a typical picture of the typhoid state. The white count was 6000, and no malarial parasites were found. There were no chills, but sweating was noted at times. A peculiar odor was emitted from the patient during his sickness. He had been taking I. Q. S. prior to the onset. On several occasions he suffered from diarrhoea with yellow, semifluid stools. A second Widal was positive in high dilution, yet the serum failed to agglutinate the paratyphoid germ. Repeated examination of the blood, fæces, and urine, however, failed to reveal the typhoid bacilli, and the patient made a fair recovery. There seems to be no improvement in the mental condition, as the retardation is even more marked than heretofore. Whether this condition was in reality a case of typhoid fever or merely a typhoid state due to the absorption of the toxic products from intestinal putrefactive bodies I am not prepared to say; at all events, it plainly suggests how a disease of this kind can for a time conceal itself beneath the shadow of dementia præcox.

In conclusion I might say that in any condition giving rise to excitement, delirium, or stupor, even though the temperature remain normal for a time, we should be very careful in our examination so as to avoid if possible a serious error in diagnosis, and at the same time keep in mind that, while a delirioid state may subside with the remission of symptoms, it may, if engrafted upon a constitutional foundation already weakened by psychopathic heredity, lead to permanent mental impairment.

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HUMAN CONSERVATION, A NEGLECTED FIELD FOR MEDICAL SPECIALIZATION

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THE human unit has not yet been placed on a par (economically) with other natural resources. It has become a world-impulse to save and utilize all crude products and domestic animals; but for the citizen (the elemental factor in the commonwealth) municipalities, up to the present, are content to exercise protection and prevention of disease, yet they disregard the large possibilities of individual conservation.

Constructive and reconstructive measures in the domain of medical practice and correlated activities are subordinated to repair work, to meeting emergencies, to focusing research on definite clinical problems.

Research is equally remunerative in formulating efficient ways and means of raising the index of vitality and sustained capacity in those whose condition leaves something important to be desired, whether due to inherent defects or acquired disabilities.

By means of expert regulation of conduct, systematic conservation or reconstruction, established upon a basis of scientific findings, enriched by the already important, though scattered and partial, contributions to medical, hygienic, or secular literature, it is entirely possible to perform new wonders of betterment. Evidence is forthcoming from highest sources pointing out that skilfully directed adaptation of the individual to his environment is a significant and available factor for human welfare. Here we have a clinical application of the broadening science of eugenics, powers of betterment through improving environment.

Expert regulation of conduct should be adjusted to particular requirements, from the standpoint of (a) the status of individual development and specialization, (b) sociologic or industrial limi-

tations, and (c) the existing states of health, vigor or relative disability. It is, moreover, reducible to percentages or other mathematical formulations. Indeed, systematic rehabilitation measures are much more businesslike procedures than emergency or repair measures which the physician is ordinarily expected to supply. These latter merely aim to stop the worst leaks in energy reserves, to patch up the organism, or to place it under the most favorable conditions for self-restoration; whereas the former takes full "account of stock"; revises and supervises till the best obtainable bases for procedure are determined.

Oftentimes the emergency work has been already well done, whereas economic, reconstructive measures are omitted, or only half-heartedly suggested, and it frequently happens that an individual urgently needs reconstructive supervision lest a worse state follow.

Unless some compelling circumstance arises to direct attention to significant facts, then to the choice of a qualified adviser, these very real but non-insistent leaks in force escape notice. Or a person may be conscious of vague losses of vigor or undefined disorders of function, and seeks counsel of a physician who is unfamiliar with, or uninterested in, suitable measures and misses the point. Thereupon, dissatisfied, unrelieved, the temptation is to seek aid of some of the multifarious well-meaning but uneducated "practical trainers," physical culturists, or venal commercialists, advertisers of cure-all "systems," so the underlying defect or damage is still unrecognized.

In the event of pronounced but obscure departures from health, there is also involved the economic problem of raising the status, or index, of vigor and proficiency from a plane of relatively lowered competence to that of which the inherent forces of the individual are capable.

Convalescence from acute disease, injury, or operation is another allied field. Here rescue measures are indicated and should be applied with full recognition of their significance. Plainly, constructive, or reconstructive, personal hygiene comes well within the domain of vital economics.

My personal attention has been directed to the capabilities of

intensive personal hygiene for thirty years. Collected data bearing directly and indirectly on the subject have grown to a respectable grouping of illuminating and effective suggestions. Hints well sustained, working principles, scientific explanations, and wise practical recommendations are to be found, richly scattered under widely divergent headings. The aggregate findings compare favorably in value with those along most advanced clinical and laboratory lines.

Let me repeat a few points mentioned in a former paper.¹

Every person, young or old, is capable of an appreciable increase in vital dynamics by revising modes of life. This is particularly demonstrable as middle age approaches and elasticity subsides. From earliest years the child begins to retrogress, to lose pliability, adaptability; to fall into one or another form or kind of disability. Some of these deviations from integrity merge into serious retrograde changes, often shown by local rigidities, densities, caused partly by faulty habits or vitiated automatisms, due to omissions of suitable variety in both impulses and energizing whereby alone symmetrical action and reaction are assured. The factors involved are both psychical and physical. The deadening effects of routine, of monotony, are well known. Stimuli should be varied; suggestion or auto-suggestion alone is rarely adequate to preserve vital rhythm.

The ultimate destiny of our civilization will depend upon the degree of efficiency of thought-power. Greater mental efficiency is demanded not only in all modern industrial pursuits but also in defensive and aggressive activities. Steps in advancing civilization are marked by increasing strains, burdens, and insults thrown upon the structures of the body, especially the most delicate of all, the brain and nerves. Each new crisis in civilization calls for the exercise of higher intelligence, increased cerebral capacity, and better judgment in "the man behind the gun."

The tendency is for each good citizen to make the best of his condition, to treat lightly unobtrusive ailments, to forge energetically ahead, ignoring slight symptoms, especially psychic phenomena; so that, too often, serious states are revealed only when far advanced or too late. This disregard of ailments is commendable; it makes

¹ "Reconstructive Personal Hygiene," *Monthly Cyclopedic and Medical Bulletin*, May and June, 1913.

for courage, endurance, and renown; for character-building and success. Through such pertinacity only are the highest ends achieved. Carried to its logical limit, however, it lures the ignorant optimist into a state of perilous monism. Conversely, overmuch self-searching leads to hypochondriasis, timidity, and inefficiency.

Unwarned, confident, one often assumes increasing burdens and presses on to or beyond the limit of working powers. Then there ensues some minor or major accident or disease, and mind and body are distorted; all of which could have been avoided by adopting one of two courses: (1) Had the family physician been observant, wise, and, above all, dominant, corrective measures could have been instituted sufficiently early. (2) Had the individual himself been duly alive to his economic needs, capable advice would have been sought and the full working efficiency reestablished.

It is true also of the specialists in almost any line that few are skilled in directing after-cures; fewer are persistent or industrious in that long supervision so necessary to reach the plane of restoration of which each patient is capable. My revered master, Weir Mitchell, was peculiarly accomplished in reconstructive measures. He insisted on maintaining supervision for months, often years. Hence his final results were, oftentimes, little short of marvellous in rejuvenation and regulation of both mind and body.

The human organism is admittedly a marvel of interacting, vitalized parts, mechanisms, and forces, a well-balanced organism, and, to quote a former paper of mine, the body is a concrete, living entity, not a mere aggregation of separate parts, like an insentient machine, any one of which is capable of acting and reacting independently of the rest. In the human machine, wherever there is local damage or derangement this can be removed only by eliciting the full coöperation of all the component mechanisms, and being aware of the interdependence of every part. Nowhere is the significance of this coöperation more direct and important than in the treatment of protracted disabilities, and for many reasons. Take traumata—fractures, wounds, and other strictly localized damages—the remainder of the organism is presumably at the time in a state of full integrity (hence with full capacity for prompt and complete repair), whereas conditions are otherwise in protracted,

long-prevailing disorders; the results being manifest in slow but steady disintegration of tissues—in the retroaction caused by depression in both the psychical and physical spheres of activity.

In acute disease, notably the infections, there is fever, a defensive process whereby the autoprotective forces are aroused to the performance of their most perfect work. The problem is then relatively simple, the organism being presumably normal when infected. But in chronic disease the defensive powers are gradually overwhelmed, and cannot be relied on to promptly meet and overcome morbid agencies. Not only this, the causal factors become increasingly complex—a blend of psychic confusion and loss of physiologic conservation. Therapeutic agencies must, then, include systematic encouragement of all functions, rehabilitation of the whole system.

Chronic morbid processes, while of wide diversity and due often to special diseased entities, none the less are at bottom mere outgrowths of vitiated physiologic processes. Physiologic processes are uniform in their manifestations, not only when normal but also when deranged. The human organism is disturbed by disease, of whatever nature, along strictly analogous lines. The special features may and do vary, but chiefly in accordance with the structures altered, rather than by reason of the nature or character of the disease itself, and the organism, as a whole, is usually capable of recovering a fair measure of efficiency.

CONCLUSIONS

1. In chronic disease the organism, as a whole, becomes exhausted through protracted, complex derangement; hence, reparative agencies are at a disadvantage as compared with the normal poise and efficiency of the organism when acute disease or injury arises.

2. Therefore, the pathology of chronic disease is something much more than that of acute states, involving many problems of morbid physiology and psychic disorder yet unsolved.

3. Remedial measures must be directed to the restitution of functional poise and include rational measures capable of conserving the autoprotective and autoregulative forces.

4. The basis of relief and cure is to be found along the line of palingenesis (development according to the primitive or original

method); the overcoming of agencies which retard physiologic processes; rehabilitation of all functional derangements, regulation of all contributory factors in vital action, so that full compensation shall be achieved of existing deteriorations.

5. The utmost drugs and medicines can do is to contribute to these desirable effects, however nearly they may approach to the rôle of "specifics," for overcoming disease entities, unlocking the doors for toxic wastes, and freeing the organism, as a whole, from disabilities present.

6. The measures on which, in the final count, we must chiefly depend are included under the term *personal hygiene*: (a) Conservative personal hygiene; (b) constructive personal hygiene, and especially (c) reconstructive personal hygiene.

7. The possibilities of reconstructive personal hygiene lie in the direction of making available latent, undeveloped energies in any adult below the norm, from whatsoever cause; in systematically utilizing the inherent dynamics, and in raising the coefficient of efficiency.

The practical purpose of this paper is to call attention to the fact that much can be achieved by bringing into line the functional power of the organs and tissues so as to secure the completest transformation of dynamic into kinetic energy, no matter what be the morbid agency.

A CONSIDERATION OF SOME PAINFUL CONDITIONS OF THE FOOT

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As has been said, the foot is a lowly member. Apparently there is no part of the human body about which so much is taken for granted, and which is so routinely and persistently neglected when in trouble, as this humble but indispensable member. I do not hesitate to state to you that twenty-five years of active hospital practice have served to fix in my mind the impression that nearly ninety per cent. of the patients applying for relief from painful feet bring mute or spoken evidence of careless, inadequate, or unintelligent examination. Far too often it happens that a patient seeking advice for pain in this area is asked a few questions, is told that he has rheumatism, is given an antirheumatic prescription and a few general directions about his diet, and is blandly dismissed without the foot ever having been inspected. It is obvious that such a state of affairs is inexcusably bad and leads the patient to go elsewhere; perhaps to another physician, who is no better; perhaps to a chiropodist, which is worse; until finally, after needless suffering and expense, he falls into the hands of the man who takes the time and trouble to discover what is the matter, and who then knows what to do for it.

It is not my intention to discuss *seriatim* the rather large number of pedal afflictions. I merely want to run over with you some of the more common painful conditions, especially those which seem somewhat obscure, or, at least, are inferentially obscure, because their recognition and significance are seldom grasped by the general practitioner.

In the first place, that we may start without prejudice or handicap, let us dismiss, once and for all, the too prevalent and erroneous idea that an afebrile rheumatism can attack the foot. Naturally this region may be involved, and usually is, in a general attack of articular

rheumatism; or, again, Neisserian infection may rarely visit its trying afflictions upon some portion of the foot; or, yet again, gout may follow its classic form and attack the joints of the great or other toes; but the broad fact remains that each of these conditions is accompanied by fever and other clear-cut clinical symptoms, and in no way negatives the axiom that the so-called rheumatism of the foot is not rheumatism at all but something else. Let us see what that something else may be.

Flat-foot.—By far the most important source of foot pain is due to flat-foot, especially that form which is known as static flat-foot, or the tarsalgia of adolescence ("static" because it is primarily due to improper balancing of the foot, and "adolescence" because it generally develops during or soon after puberty). Allied conditions, such as congenital, rhachitic, paralytic, or traumatic flat-foot, may be passed over in this connection with the simple statement that they involve problems of varying difficulty which properly belong well within the domain of the expert orthopædist. Static flat-foot, on the contrary, especially in its early and curable stages, is common enough to merit the liveliest interest of every well-trained physician.

Let us glance for a moment at the mechanism involved before taking up the clinical phases. Functionally the foot consists of a supporting arch with the body weight resting upon its apex or keystone, the astragalus. Inasmuch as the osseous elements making up this arch are not solid but are movable on each other, and serve to form an arch only in certain definite positions, another factor must be considered: that of the ligaments binding the various bones together. These latter structures, as a matter of fact, form the main resistance in preventing the arch from sinking. It is therefore clear that the integrity of an arch so constituted depends upon two factors,—the absolute strength of the ligaments, and the incompressibility of the bones. As a subsidiary factor, the calf muscles acting indirectly may be mentioned as contributing to a certain extent to the tensile strength of the arch, but not so much as was formerly supposed.

When the weight of the body comes upon the foot the mid-line of the arch neither corresponds to the inner nor to the outer border of the foot, but quite closely follows its longitudinal axis. In front it is supported by the head of the third metatarsal and behind by the os calcis, while curving between are the third metatarsal, the external

cuneiform, the cuboid, and the astragalus. The weakest point along this line is the joint between the cuneiform and the cuboid, for the reason that it deviates about forty-five degrees from the curved plane of the arch instead of being perpendicular to it. The side strain which results thereby does not fall on this joint alone, but is transmitted and resisted by the astragalus, the scaphoid, and the calcaneus, and through them by the other tarsal elements. The anterior transverse arch, formed by the heads and foreparts of the metatarsals bound together by the strong transverse ligaments, is another important element of weight support, but the part it plays in flat-foot is greatly overshadowed by that of the longitudinal arch.

Now, in a normal foot of solid bones, unyielding ligaments, and muscles of good tone there is no tendency whatsoever toward valgus deformity, but just as soon as it becomes tired to the point of exhaustion there will invariably be seen some degree of the eversion which always suggests flat-foot. The thoroughly foot-tired man stands with knees slightly flexed, feet separated, and toes turned out. With such a posture the weight invariably comes upon the inner side of the foot, and the foot in time becomes more and more everted and abducted. The effect of this, if long continued, is to stretch more and more the supporting ligaments and finally to cause material alterations, even to the extent of changing the shape of the bones.

The anatomical explanation of this phenomenon is very simple and points directly to the well-known fact that flat-foot in its beginning is merely an exaggeration of a perfectly normal motion of the bones of the foot. The weight of the body as it comes upon the astragalus presses it downward and forward upon the calcaneum and at the same time rotates it inward about the oblique axis of the joint between these two bones. Excessive rotation of the astragalus at the calcaneo-astragaloid juncture invariably characterizes temporary, incipient, or permanent flat-foot. Inasmuch as the astragalus is quite firmly fixed at the ankle, the effects of excessive rotation are manifested in deviation and eversion of the more mobile foot. As the condition advances all the bones of the tarsus become altered in position and frequently in shape through the transmission of stress along abnormal lines, the ligaments are stretched, thickened, and twisted from the same cause, until finally there develops a distinct pathology with demonstrable changes in the hard and soft parts.

Certain fundamentals may be pointed out with reference to the causation. As has been just stated, flat-foot in its earlier stages merely represents over-emphasized fatigue, without any pathology at first, and is entirely remediable. It occurs, as a rule, between the fifteenth and twentieth years, although it may develop in later life in soft-muscled individuals, especially women, who have suddenly grown obese. It is commonly seen in those persons who are obliged to walk or stand for long periods, such as shop-girls, textile workers, porters, barbers, errand boys, servants, etc. Often I have observed it in trained nurses during, or shortly after, their probationary period, with the attendant misfortune that their further training had to be foregone. Hard work involving continued standing in any young individual who has grown rapidly and whose muscles are weak predisposes toward flat-foot. But over and above these factors in importance, at least in my estimation, is the prime factor of faulty habitual posture in walking and standing. There is but little doubt that the improper weighting of the foot is more important than the overweighting in the etiology. To "toe out" involves an abnormal rotation of the astragalus inward in order to extend the foot, and it is well within the experience of every pedestrian that walking with the feet in this position quickly causes exhaustion; exhaustion in turn tends toward inward sinking of the arch; and the signs of long-continued or frequently recurring exhaustion and of beginning flat-foot are precisely identical. In a way the whole situation may be considered as a vicious circle; i.e., a bad postural habit leads to exhaustion, exhaustion leads to flat-foot, flat-foot fixes and renders permanent the bad posture. In light of this fact, could anything be shorter sighted than the common parental insistence that growing children should learn to stand and walk with the feet in what is popularly known as graceful attitudes?

The symptomatology of flat-foot in its earlier stages may be summed up in two words: *fatigue, pain*. Both of these are generally seen before any distinct deformity can be made out, and, as a matter of fact, the pain is less pronounced, as a rule, when the altered shape of the foot has become clearly demonstrable. Both are increased by long standing or walking. Sometimes the pain may occur acutely after a particularly excessive use of the foot, and in these days of almost universal dancing the significance of sudden foot pain must

not be overlooked in this relation. With the pain are seen definite areas of tenderness, and here it is that a careful examination of the foot becomes so essential. These point of tenderness are elicited by pressure over the tuberosity of the scaphoid, the head of the astragalus, and the juncture of the latter bone with the calcaneum. Frequently the entire under surface of the heel is painful. Much less often tenderness may be found about the metatarsophalangeal joints, on the dorsum of the foot, or about the external malleolus. With all of this pain and tenderness the plantar arch may yet appear normal, but there is always present that excessive eversion of the foot which has already been emphasized. In manipulating the foot the passive forced movements of inversion or eversion always augment the pain, but the movements are otherwise normal in range.

In addition, patients often complain of cramps in the calf muscles or those of the foot, sometimes occurring at night while at rest, or sometimes while walking, but in either instance followed by some increased stiffness and lameness. When standing they will shift the weight frequently from one foot to the other. In some extreme cases where the foot is very painful the muscles are almost spasmodically tense, the foot is held firmly in abduction and eversion, and voluntary flexion and extension are decidedly limited. Now and then there will be found some swelling of the ankle, and it is probable that on this slender peg the erroneous diagnosis of rheumatism hangs.

With your permission I shall omit all reference to flat-foot in its later or final stages, the true talipes valgus, a subject of absorbing interest but hardly germane to this paper. I would merely remind you in passing, however, that neglect of flat-foot in its early curable phases may, and generally does, lead to the more serious, ineradicable, pathologic state with its attendant disfigurement, mental and physical distress, and lowered economic efficiency.

In considering the treatment of flat-foot too much emphasis cannot be placed on prophylaxis. We have seen how fatigue plays its part, how faulty posture is an element of great importance, how individuals of a certain type and at a certain particular age are affected, and how those who are engaged in certain occupations are subject to it. In a social organization as complex as ours it is never possible to order things quite to our liking, but it is still practicable, and our sacred duty demands it, that we should advise our patients

in definite terms how to avoid the accident of flat-foot so far as possible. Occupation is, of course, the most difficult problem to settle. Public opinion has already effected some reforms in forcing employers to provide means by which their employees may adequately rest the feet by sitting down from time to time, notably the conditions under which shop-girls work have been improved, but much is yet to be done in other lines. Change of occupation is sometimes required in the individual case. It is most unfortunate that the matter of faulty posture is one to which little attention is given, and yet during the formative period of life, when flat-foot is so apt to appear, the lesson of correct standing and walking is not likely to be thrown away. To teach growing boys or girls to stand with their feet side by side well under them and to walk with the foot in the axis of the limb, straight heel and toe, as it were, may establish a sound postural habit which will confer immunity from at least this type of foot trouble throughout life. The parents of rapidly-growing children should be instructed in the significance of foot pain and the importance of avoiding foot fatigue, and not lulled into a sense of false security by any old woman's tale of "growing pains." There is no question that defective local circulation also plays an important part in the production of flat-foot, as well as nearly all the other painful foot conditions, and, therefore, the practice of wearing circular garters is strongly to be deprecated.

When it happens, however, that the first opportunity to advise comes in the presence of a definite static flat-foot in its early stages your efforts should be direct, vigorous, and comprehensive. Under no circumstances resort to a fallen arch plate until you are quite sure that all other measures have failed. Treatment should contemplate rest, exercise, massage, hydrotherapy, and proper footwear. The patient should be taught to stand or walk with the toes turned in, to often rise on his toes in this position, to assume a squatting position and to rise from it while resting on the heels with the feet strongly inverted—all in order to strengthen the muscles and improve the circulation. Daily massage, even if self-administered, is of the greatest possible benefit, especially if it is combined with the frequent circulatory stimulus of hot- followed by cold-water douches. The patient should be instructed to seize with avidity and premeditation every opportunity to rest the exhausted structures by sitting or lying

down, and to persist in these and other measures long after all symptoms have disappeared. If the occupational factor seems the dominant one, and the circumstances cannot be modified, then a change may be necessary to less arduous and exacting working conditions. Above all, do not forget that the complete rest afforded by a few days in bed may prove the decisive measure in the cure of a doubtful case.

The problem of proper footwear is one which permits of divergent views. My own preference is for a shoe which can readily be obtained in the larger shops, or can be easily made to direction by any good shoemaker. It has a broad, firm sole, soft upper, and two or more modifications of the heel. The first modification is a projection forward for about an inch of the inner third, the purpose of which is to supply a support to the weakened arch. The second change that I advocate is an approximate alteration of the height of the heel to allow for the contraction of the tendo achillis, which is so common in these cases. It is well to guard the heel against wearing down on the inner edge by having inlaid in the leather one or two metal V's. Finally, it is sometimes advisable to have the inner edge of the heel a trifle higher than the outer. This should not be over a quarter of an inch, and usually an eighth will do.

In my opinion, the use of metal supports is always a mistake in the earlier stages, and should not be considered until you are willing to confess defeat. If, and when, a plate becomes necessary, bear in mind that most of those which are sold are worse than useless. The Whitman plate, however, is not in this category and is theoretically and practically sound. It is made of sheet steel or aluminum-bronze, extends from the heel to the base of the great toe and from one side to the other, has a curve corresponding to the normal arch, and not only has a full inner curved portion but also a flange upturned on the outer side to prevent the foot from slipping outward. In the individual who cannot be cured such a plate may be worn permanently with much relief of the accompanying discomfort and disability.

In the foregoing I have purposely not spoken of the extremely acute type of flat-foot, nor of the severe chronic type, nor of the various operative procedures which may be considered in connection with either, but have confined my remarks to the average case which is so apt to come under your notice and which will expect from you relief and cure.

Metatarsalgia.—In 1876 an eminent Philadelphia surgeon of a former generation, the late Dr. Thomas George Morton, first described a painful condition of the foot which has since been known as Morton's toe or metatarsalgia. An early association with him, and later with his gifted son, Dr. Thomas S. K. Morton, enabled me to become thoroughly conversant with the clinical phenomena of this interesting disease, and since then I have had the opportunity of studying and operating upon it in a considerable number of my own patients.

It may be described as a painful neuralgic condition affecting usually the neighborhood of the fourth metatarsophalangeal joint, though rarely it may involve the third or second. Generally slight trauma, such as stepping on a sharp stone or a misstep of some sort, seems to play a part in its incidence. In sharp contrast to flat-foot, it is practically never seen before the twenty-fifth year. It is much more common in women than in men, doubtless due to the feminine habit of wearing tighter shoes with higher heels, which not only confines the forefoot, but pitches it forward. In severity it varies from a transitory sharp twinge to an affliction so marked as to cause continuous suffering, with an entire inability to wear a shoe. A typical history details that the patient, usually a woman, while walking feels a sensation as though something had slipped or moved in the anterior foot, and at once is seized with a paroxysm of such agonizing pain that she is obliged to stop where she is, or, if in the street, to seek refuge in the nearest shop, in order to obtain relief by removing the shoe, extending the toes, and rubbing the foot. Presently the pain disappears and she is able to go on, either with or without some slight resulting lameness.

Morton ascribed metatarsalgia to a pinching of the digital branches of the external plantar nerve between the somewhat recessed head of the fourth metatarsal and the neck of the adjacent third metatarsal. He further held that tight and short shoes were directly responsible for its occurrence. Since the appearance of his papers, however, much attention has been given by Whitman, Goldthwait, and others to the whole subject of the anterior metatarsal arch in relation to various other painful conditions, and it is now an open question if Morton's neuralgia should be considered apart from these. A brief reference to this arch may be illuminating in connection with the relation of

weakness of it to painful symptoms. In the normal foot the second and third metatarsal heads are on a higher plane than the first, fourth, or fifth, but when supporting the body weight they become level with the others. In other words, there alternates normally a state of arch and no arch, depending on the absence or presence of weight. The highest point when at rest, the head of the third metatarsal, becomes the lowest when standing or walking and is the main anterior support of the foot, as I have already pointed out. This point of support is balanced laterally by the muscles about the first and fifth metatarsals and by the toes in general. There is also a high degree of natural resiliency given by the transverse ligaments to the whole arch.

Now when the normal elasticity of the arch is lost for any reason and the bones become persistently depressed, or indeed permanently fixed in this abnormal position, there ensues an active predisposition to pain. This arises from two sources,—pressure from below, and pressure from the sides. As to the former, I shall have a few remarks to make when I discuss painful callus, but just now let us note the effect of undue lateral pressure. It is probable that if the factor of shoes did not enter into the question there would be slight, if any, discomfort from such pressure on a depressed anterior arch, but the wearing of shoes supplies the extraneous feature which is necessary. When the heads of the metatarsals are permanently depressed they present to their fellows a surface totally unused to pressure, and hence are apt to become painful through slight changes in bone or periosteum incidental to chronic irritation. Only recently, in examining a radiograph taken of a patient suffering from metatarsalgia, I saw evidences of slight osteitis on the inner side of the fourth metatarsal head. Undoubtedly such changes may occur elsewhere at any point on the arch. It must be remembered that the brunt of tight shoes falls directly on the outer supports of the foot, the first and fifth metatarsals, and particularly on the latter, because the shape of the shoe raises it and consequently jams the head of the fourth downward into such a position as to pinch the nerve. An explanation such as this may readily account for some of the cases of metatarsalgia. It is perplexing, however, to find in other cases no evidence at all of a depressed anterior arch. In these it must happen that the arch depression occurs only when the shoe is on and disappears

when the shoe is removed. This theory is borne out by the well-known desire of the patient to remove the shoe when the attack is on, and also by the complaint that the attack started with a sensation as though something slipped. Instinctively the patient seems to act as though the reduction of a misplaced bone was the object of her efforts.

The actual diagnosis of metatarsalgia, aside from the history, is easily made by squeezing the foot with the hand while the toes are pressed down. The characteristic pain is produced either by this manoeuvre alone or by pressing on the fourth metatarsal joint.

Treatment.—In the mild case attention to footwear seems sufficient to obtain relief. The use of a broad-soled, rigid shoe with a low heel is quite enough to accomplish a cure in many cases. In the more severe form, additional efforts must be made to give support to the depressed anterior arch, and I know of nothing quite so satisfactory as a carefully moulded leather insole. Personally I have never seen any benefit arise from the use of a band of adhesive plaster about the forefoot, as recommended by some surgeons. For very severe metatarsalgia, in my experience, nothing will do but a formal excision of the offending metatarsal head. Formerly I did a simple excision and left the toe alone, but now I remove both the joint and the corresponding toe, because if the latter is retained it becomes in time only a hammer-toe and causes further annoyance.

Painful Callus.—Callus or corns represent a large portion of the net income from too tight or otherwise ill-fitting shoes. Most people seem to prefer the occasional discomfort and annoyance of them to changing settled habits in footwear. Such benign aberrants practically never seek advice from us. There is, however, one form of painful callus which merits some attention in passing. I refer to the callus which is seen on the sole of the fore part of the foot. It is callus which does not lend itself in the slightest to the corn-paring, corn-plaster methods of treatment of the amateur, and for that reason is apt to come to our notice. Examination of a foot so affected will show that it is always beneath the head of the third metatarsal, and further investigation will develop the fact that there is always present a depressed anterior arch. Here we have the painful phenomena arising from a structural defect within the foot, and all measures to obtain relief are futile which ignore this fact. The proper treatment

is obvious,—the support of the anterior arch by some means such as a properly-fitting and padded insole. Pain disappears almost at once and the callus soon goes.

Tarsalgia.—Dr. William J. Merrill has described recently a form of static painful foot, which is apparently quite common, under the name of tarsalgia, and in conjunction with Dr. P. G. Skillern, Jr., has carefully studied the pathologic anatomy. Clinically it is characterized by lancinating pain in the neighborhood of the mediotarsal joint and pain in the posterior tibial muscle. Frequently pain and tenderness occur in the long flexor muscles of the toes, and occasionally slight pain is noted in the anterior tibial. Fatigue and spasm are also dominant features. In some respects the symptoms accompanying flat-foot are similar, but with real tarsalgia there are such radical differences that a differential diagnosis is easily made. The main points are that the arch instead of being depressed is increased, and instead of a valgus deformity there is a tendency to varus.

Merrill's explanation of this condition is direct and logical. He holds that as the result of disturbed muscle balance, due to many causes, the anterior tibial muscle loses power and tone, and hence the posterior tibial and toe flexors are stimulated to greater action to compensate for this deficiency. Under continued stimulation there must result either muscle relaxation or spasm. If spasm occurs the posterior tibial tends to uptilt the os calcis and to create in varying degrees an upward subluxation of the astragaloscaphoid and the calcaneocuboid joints. Hence we see the reason for the higher arch and for the varus deformity.

For treatment he advises rest, massage, and exercises. If severe, he uses a plaster-of-Paris case to secure the prolonged and complete rest which is needed; in mild cases massage of the leg muscles and the foot, adapted exercises, and proper footwear are usually adequate to accomplish a cure.

Painful Heel.—For many years I have been accustomed to seeing in my clinic now and then a patient suffering from an extremely painful, acute condition of the heel, which, for want of a better name, I have called "motorman's heel." Since it has been so well described by Shaffer, I have called it Shaffer's heel, but it still needs a good descriptive title and further elucidation of its pathology.

Clinically it is characterized by severe pain accompanied by

tenderness at and about the posterior insertion of the plantar fascia into the os calcis. In my own experience it is always due to oft-repeated trauma, and I have seen it mostly in motormen, caused by stamping on the bell plunger. Occasionally policemen and workers who use a treadle have come under my notice. However, I am told that it affects acrobats, supposedly as the result of sudden violent effort and not of direct injury. Aside from the pain and tenderness, with the attendant lameness, there are no physical signs. It is easily differentiated from the plantar pain so often seen in flat-foot by the greater degree of intensity of pain and tenderness, by the very definite localization of this pain, by the absence of flat-foot, and by the occupational history. The lesion in the great majority of cases is probably an inflammation of the bursa beneath the calcaneum, but there are others in which the subsequent appearance of exostoses would suggest local periostitis, or even perchance near-fracture, as an adequate explanation for the symptoms.

The treatment is very simple and generally is entirely satisfactory,—abatement of the vulnerating cause, the wearing of a hair or wool insole, and the use of rubber heels.

Before I bring this paper to a close I want to call your attention to two interesting, though rather rare, painful conditions which affect the back of the heel: achillodynia and retrocalcaneal bursitis.

The former was first described some years ago by Albert, the Viennese surgeon, as a painful bilateral affection occurring in the tendo achillis. The pain appears after walking and is relieved by resting, but the symmetrical swelling permanently remains. The important symptoms are given by Eshner as follows: "The circumscribed character and symmetry of involvement, the thickening above the heels, the absence of inflammatory symptoms, the presence of pain only after walking, and the rapid subsidence of the first attack." Constitutional causes and trauma are absent, and, as a matter of fact, the etiology is entirely unknown.

In sharp contrast to this affection is retrocalcaneal bursitis, which consists of a unilateral inflammation of the bursa between the tendo achillis and the tubercle of the os calcis. It usually results from direct injury or severe muscular action, but not infrequently it may be due to hæmatogenous infections, such as sepsis, syphilis, gonorrhœa, tuberculosis or rheumatism. Here, as elsewhere, ill-fitting

shoes may play their part in the causation. Local tenderness over the insertion of the tendo achillis, swelling and later broadening of the heel from calcaneal exostoses, together with lameness and tenderness of the calf muscles, are the cardinal symptoms. The treatment consists of rest, with massage and counterirritation in the later stages. If the bursa is infected it should be opened and drained, and if exostoses remain permanently they should be removed. In the presence of tuberculosis the whole bursa must be carefully excised.

There are many other topics pertaining to the foot which are deserving of careful consideration, but I realize that I must not let my pedal enthusiasm, as I may call it, try your patience too far, or the intended effect is lost. If I have succeeded at all in arousing in you an interest in this direction, and especially in some of those affections which are so often overlooked, the full and only purpose of this paper has been accomplished.

Surgery

THE ORTHOPÆDIC CLINIC OF FRED H. ALBEE AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL

BY P. G. SKILLERN, JR., M.D.

Philadelphia

WHEN one turns his attention toward the epoch-making bone-work of Dr. Fred H. Albee it seems but natural to learn that it is the result of the knowledge of tree-grafting obtained in boyhood days, combined with a mechanical bent of mind. Added to this are the years of anatomical and surgical training as assistant of that master surgeon, the late Dr. Maurice H. Richardson, and the later opportunities afforded by serving for a long time as röntgenologist.

The Orthopædic Clinic is held four days a week, at two o'clock. On Monday there is a lantern-slide demonstration, in which Dr. Albee discusses the mechanics, the pathology, and the treatment. The slides, made from skiagrams, photo- and microphotographs, diagrams, and drawings, include two hundred and fifty on bone-graft work alone. On Tuesday and Thursday there is an operative clinic, in which operative technic is demonstrated. Later on Tuesday afternoon there is a ward-visit for study of postoperative conditions recently operated upon: this is preceded by a half-hour in the dispensary amphitheatre for cases operated upon months or years back. On Saturday there is a diagnostic clinic for dispensary cases.

In addition to the Post-Graduate, Dr. Albee also operates at the Roosevelt Hospital, the Blythedale Home for Crippled Children at Hawthorne, the Plainfield Hospital, and the University of Vermont.

The following account of his work has been culled from witnessing operations at the first four institutions, and from protracted interviews, in which the ground was thoroughly "hashed" over during many pleasant hours. There will first be discussed the subjects in which Dr. Albee is most interested; namely, osteoplasty of the spine for Pott's disease, and the inlay bone-graft in the treatment of frac-



Fred H. Alber

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tures; next, the description of a few operations; and, finally, a systematic discussion of the entire field of his work from the head to the foot.

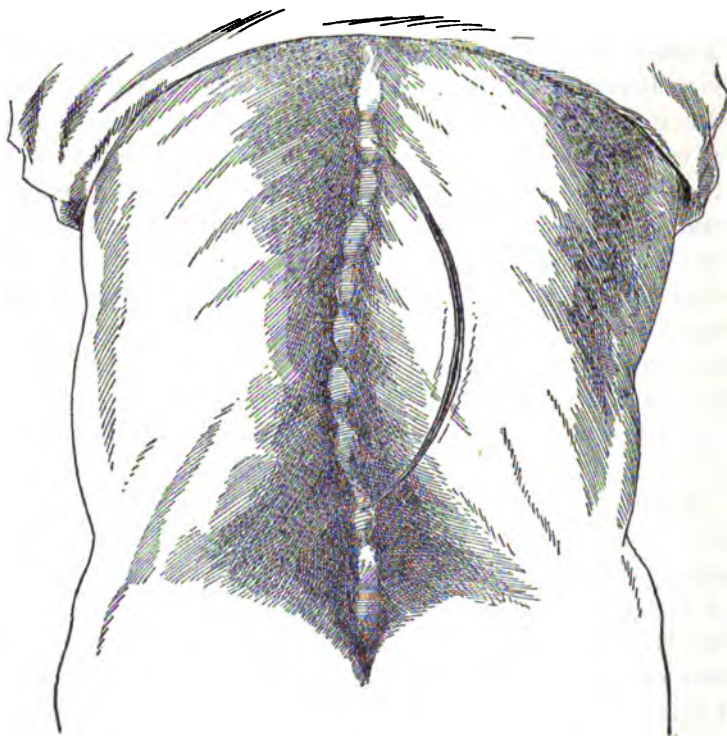
OSTEOPLASTY OF THE SPINE FOR POTT'S DISEASE (ALBEE'S OPERATION)

If one turns back over the files of the *Journal of the American Medical Association* to September 9, 1911, vol. lvii, pp. 885 and 886, he will see the first report of this operation, which is now known and performed throughout the world. It is entitled: "Transplantation of a Portion of the Tibia into the Spine for Pott's Disease: A Preliminary Report." In the opening sentence he writes: "I was induced to undertake this work on the spine on account of the excellent operative results obtained in tuberculosis of joints elsewhere in the body, where bony union with its perfect support and immobilization has caused the tuberculous process to disappear so rapidly, although only a fractional part of the tuberculous tissues was removed." In principle the operation is based not only upon this splint, but also leverage, action. In the latter the fulcrum are the lateral processes; the long arms, the spinous processes; and the short arms, the vertebral bodies. In this way fixation of the spinous processes prevents telescoping of the bodies, and the nearer the graft is placed to the tips of the spinous processes the greater the leverage. This is most important, as telescoping of the vertebral bodies, due to superincumbent weight, muscular spasm, and respiratory action, is a gross factor in prolonging the convalescence of Pott's disease. Furthermore, because of the dorsal projection of the spinous processes, the focus of disease (in the bodies) is not entered, so that immediate bony union with primary union of soft tissues can be expected. Therefore the bone-graft is the simplest and most trustworthy method of actually immobilizing the diseased vertebræ, which is impossible by external means. The latter *prevent expansion of the lungs*—a serious handicap in the cure of tuberculosis.

Technic of Osteoplasty of Spine.—With the patient in the ventral position, a curved incision is made through the skin and subcutaneous tissue only (Fig. 1). The advantage of the curve is that the scar does not rest directly over the spines, as occurred in the early cases, when the straight incision was used. The flap is dissected from the deep fascia and retracted to the opposite side, exposing the tips of

the spinous processes and the supraspinous ligaments (Fig. 2). With a stout scalpel the periosteum on the tips and the supraspinous ligaments are split in the median line. Continuing, the interspinous ligaments are split into approximately equal parts to a depth of about one-half inch, without disturbing their attachments to the spinous processes. Hemorrhage is slight, and contrasts with that encountered in laminectomy, where the muscles are separated from

FIG. 1.

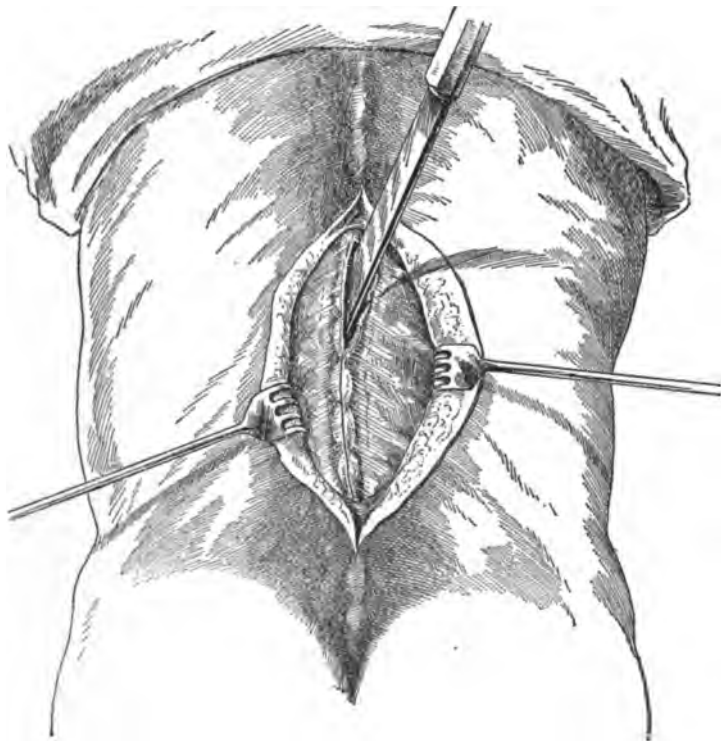


Osteoplasty of spine. Curved incision through skin and subcutaneous tissue.

the spines. Next, with Dr. Albee's special broad chisel, which spans more than one spine at a time and thus prevents inadvertent slipping into the vertebral canal, the spinous processes are split longitudinally into equal parts for the same depth as the ligaments, the aim being to produce greenstick fractures on one and the same side (Fig. 2). This completed, there results an osseo-aponeurotic gutter ready for the reception of the tibial transplant (Fig. 3). The characteristics

of this gutter are these: it is V-shaped, with the apex of the angle anteriorly at the bases of the spinous processes. The sides of the angle are formed by the halves of the rough, split spinous processes, which are bound together by the interspinous and the supraspinous ligaments. Externally the attachments of the vertebral aponeurosis and spinal muscles to these structures remain undisturbed, preserving the natural supports of the spine. The gutter is measured by a

FIG. 2.



Osteoplasty of spine. Flap reflected, exposing tips of spines and supraspinous ligaments. With the special, broad chisel, greenstick fractures of the spinous processes are produced on one and the same side.

flexible probe for contour and length: calipers may be used for the latter. A hot saline pack is now placed in the wound, pending the removal of the transplant from the tibia.

Removal of Transplant from Tibia.—With the patient still in the ventral position, the leg is flexed on the thigh and a long incision is made to the inner side of the crest of the tibia, preventing the scar forming over the crest. The skin and subcutaneous tissues are dis-

sected back so as to expose the antero-internal surface of the tibia. If the transplant is to be straight, as in the absence of marked kyphosis, its length is measured on this surface of the tibia by the calipers, and with the motor-saw that portion adjacent to and including the crest is removed. In length the transplant must span, in addition to the diseased vertebræ, two healthy ones above and two below if in the thoracic region, and one each if in the lumbar region. In breadth it varies from one-fourth to five-eighths inch. Its thickness is that of the tibia between periosteum and medullary cavity, which varies, according to the size of the bone, from three-sixteenths to three-eighths inch. When the kyphosis is so marked that it will not take a straight splint, its shape is outlined on the periosteum with a scalpel, according to the pattern obtained from the spinal gutter by the bent probe, and the single saw follows the cuts in the periosteum (Fig. 4). This splint is angulated rather than curved, for if curved the saw will bind. In cases with extreme kyphosis the transplant is cut straight, and then bent by the following method, after which it is inserted into the spine with its breadth in a frontal rather than sagittal plane. After removal it is held with forceps by an assistant, with the marrow side up. With the single saw, the depth of the blade of which has been graduated by a metal guard, cross cuts are made whose depth corresponds to from one-half to two-thirds of the thickness from the marrow side to the periosteum, and from one-half to three-eighths inch apart, along the entire length of the splint, which varies from four to seven and one-half inches. The periosteum is then incised in many places. A hot saline pack is now placed in the wound on the leg.

Insertion of Transplant into the Spine.—Upon removing the pack from the spinal wound it will be found that active bleeding has ceased. The residual blood, serum, and plasma furnish a good culture medium for the bone-graft. The straight graft is inserted into the gutter in such a manner that the marrow surface contacts with the unbroken halves of the spinous processes and their connecting interspinous ligaments. One narrow edge is anterior and one posterior, and the periosteum rests against the broken halves of the spinous processes, with their connecting interspinous ligaments. It will now be found that by pressing the halved spinous processes upon the graft with the fingers a very secure grip is obtained by the mere approximation of the rough bone-surfaces. Beginning at the centre

Food Type	Number of People
Fruit	2
Vegetables	4
Grains	3
Protein	5
Dairy	6

FIG. 4.



Osteoplasty of spine. Removal of angular tibial graft with single motor-saw. The calipers and the bent probe are shown.

of the graft, interrupted sutures of heavy kangaroo-tendon are passed through the supraspinous and the posterior edges of the halved interspinous ligaments, near the tips of the spinous processes. When a graft bent by notching is used, since its breadth is placed in the frontal plane, it can be secured better by stitching the vertebral aponeurosis over it, and where there is much tension this aponeurosis may be cut laterally, relieving the tension (Fig. 5). A dozen sutures may be necessary. Before tying the last ones, the posterior corners of the graft-ends are nibbled down with the rongeurs, to prevent pressure-necrosis of the overlying skin. The bone-chips thereby obtained are placed about each end of the graft, to act as multiple osteogenetic foci (Fig. 5, *B*). The ends of the graft are then drawn down by tying the sutures over them. The skin edges are approximated without drainage. The dressing consists of a large, gauze pad, retained by adhesive plaster. The wound in the leg is closed by apposing the skin-margins. The gutter in the tibia heals within three months, according to Wolff's law.

Postoperative Treatment.—The patient is placed upon a fracture-bed in the recumbent position. A child may be prevented from tossing about by pinning a towel placed around it to the bed. Rest in bed is maintained for from six to eight weeks, although there is bony union of the graft within four weeks. At the end of the above period the patient is allowed to walk about gradually. Plaster jackets and braces are unnecessary, as they interfere with respiration as well as with the function of the graft, and exert undue pressure upon the latter. All patients receive from the beginning the treatment for tuberculosis in general.

After operation the pain disappears immediately, due to the excellent fixation of the spine. A little girl seen at the Blythedale Home, upon whom this operation had been performed twenty months previously, did a ballet in a Christmas celebration. A patient with upper thoracic Pott's came into the home with a plaster jacket and jury-mast which another surgeon had applied after Dr. Albee's operation because he did not trust the graft. Dr. Albee removed these apparatuses, and the child has done well since. This has occurred in three cases.

Indications for the Operation.—In any case where pain or muscle-spasm exists, and for the prevention and correction of increas-

ing deformity. *Here Dr. Albee made a special plea to operate upon cases early, before deformity has occurred: then there will not be a hunchback anywhere in the world.* It is also urgent in late cases, however, that are complicated by psoas spasm, cold abscess, or paraplegia.

A little patient was seen at the Blythedale Home who had paraplegia from Pott's disease in the upper thoracic region, and who had been operated upon March 1, 1913. Six months later the paraplegia had disappeared, and the child now walks without difficulty.

Cold abscesses about diseased vertebræ are revealed in the skiagrams. A pool of tuberculous pus, however, does not interfere with the vitality of the bone-graft. Dr. Albee never opens and drains a cold abscess, because of the dangers of secondary infection, septic absorption, and amyloid viscera. He stated that it does the patient harm the surgeon can never retrieve. Some severe double psoas abscesses have healed spontaneously in from six to sixteen weeks after the spinal operation. Once opened, a sinus may result, and be kept open by a sequestrum, or persistent infection of soft tissues.

At the Roosevelt Hospital the following case, which had been referred to Dr. Albee by Dr. Peck, was seen: Male, Italian, aged twenty-six years, was admitted for a large abscess in right iliac fossa and another in left iliac fossa. There was a small kyphosis at the first lumbar vertebra. Skiagram showed destruction of two vertebral bodies in this locality. At the operation, in February, 1913, a bone-graft was inserted over four vertebræ. The patient left the hospital at the end of five weeks. Two weeks later, or seven weeks after operation, he went to work in a brickyard. After working for six months he took another job as night fireman, shovelling coal into a stationary boiler. The abscesses were never touched. After eight months a slight thickening was palpable in the right iliac fossa, but nothing was to be felt in the left iliac fossa. He gained from fifteen to twenty pounds and considered himself well.

Surely the following case ought to convince sceptics, especially those who have wilfully remained such, of the efficiency of the operation:

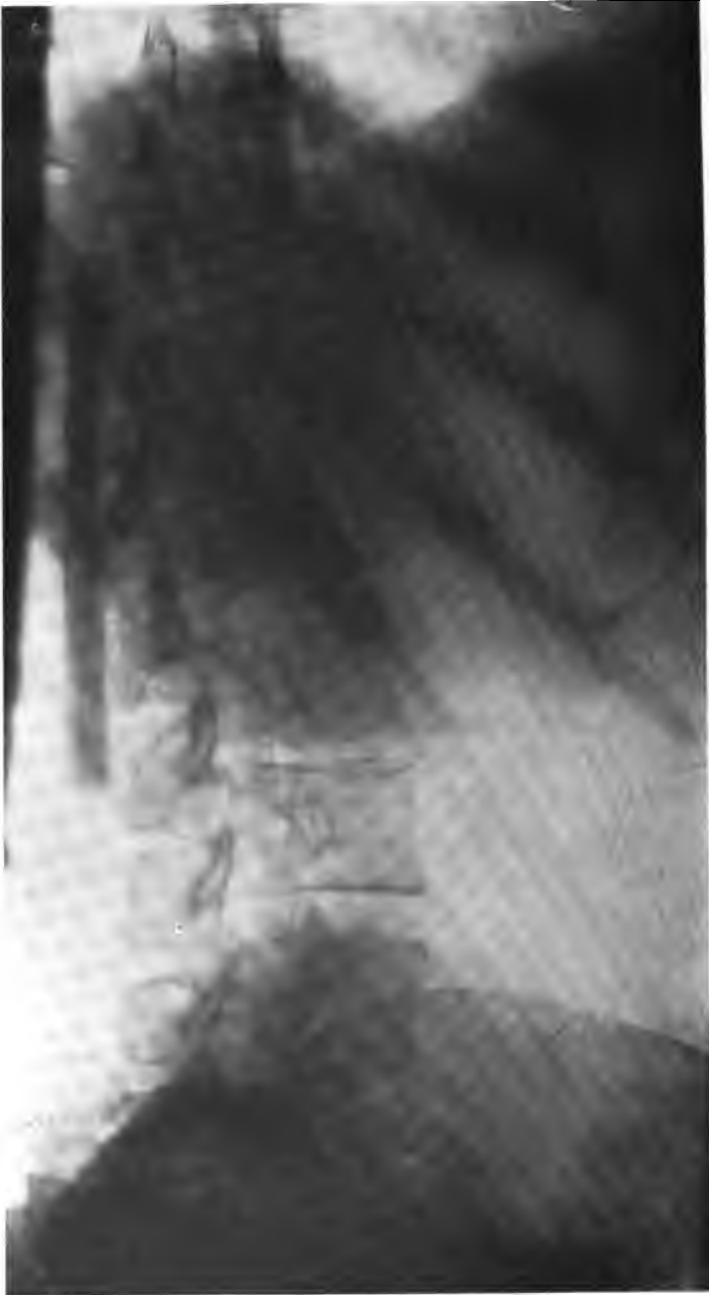
Another surgeon had inserted a bone-graft into a child's spine, and had even applied a plaster jacket, but still the patient showed lack of spinal support by resting the chin on the table and the hands on the knees; by night cries, and by refusing to play with other children. Skiagram showed that *graft was entirely above the site of kyphosis, and that it was half the length it should be.* At the second operation Dr. Albee found the graft to be of excellent shape, and that it had proliferated. He took off one side of the graft and turned it down into the spinous processes below. Since the graft was lengthened the control of the symptoms has been perfect.

FIG. 5.



Osteoplasty of spine. The graft in its bed. The vertebral aponurosis is being sutured over it. Lateral cuts to relieve tension are shown just below the retractors. *B* shows bone-chips placed about end of graft.

FIG. 6.



Osteoplasty of spine. Skiagram of vertebral column involved in Pott's disease at first lumbar vertebra. Tibial graft in position. Lateral view.

Mechanical treatment means many years before bony union occurs, while with operation this union takes place within four weeks, if well contacted.

In the visits to the various institutions mentioned above there were seen under Dr. Albee's care twenty-three cases of Pott's disease. Of these, eighteen involved the thoracic, one the cervicothoracic, three the lumbar, and one the thoracolumbar region. The mode of onset in several cases was interesting.

One patient, a Russian, machinist, aged thirty-five years, had complained for four years of sharp and dull pains in the middle of the back, radiating to left side of abdomen. *He had been treated elsewhere for pleurisy and muscular rheumatism.* Lateral bending was limited. The upper thoracic region was involved. The sensitiveness left at the operating table, and there has been complete relief of pain.

Another patient, aged seventeen years, noticed six months previously that he could not use his back so freely as formerly, and that a dull pain had arisen. The kyphosis in the back was constantly increasing. The thoracic region was involved.

A male, aged sixteen years, experienced seventeen months previously the slow onset of gradually-increasing kyphosis and constant pain, night and day. Any jar, riding in a carriage, etc., caused pain.

A man, aged twenty-four years, worked hard for eight and one-half years in the lumber business at chopping. Six months later pain began in the back, and eighteen months after this kyphosis developed. Any jar aggravated pain in back. After operation the pain disappeared.

A brakeman, aged thirty-five years, nine months previously was thrown across the vestibule of a car, so landing that the back struck against a sharp metal corner. After this, pain began along the course of the left twelfth rib, for which latter was resected elsewhere six months ago, but pain continued. Four weeks ago began to complain of pains in back and a sensation of weakness. A skiagram taken in the anteroposterior position was negative. Another, taken from an *oblique* view, showed a tuberculous focus in the anterior portion of the lower half of the tenth thoracic vertebra, left side. A graft was inserted into the spine so as to span five vertebrae. The "rib" pain disappeared after the operation.

This last case emphasizes the importance of *taking skiagrams from several aspects*, not only the anteroposterior, but also the oblique and the lateral. The necessity for this is apparent when one considers the body of a vertebra, in which tubercle lodges, as a rounded block of bone.

The cuts (Figs. 6 and 7), obtained from skiagrams taken in the X-ray Department of the Post-Graduate Medical School, serve to orientate the graft *in situ*. The patient, E. G., female, was operated upon by Dr. Albee on December 16, 1914, for Pott's disease that involved chiefly the first lumbar vertebra. In the anteroposterior view (Fig. 7) the graft is seen resting in the split spinous processes of the eleventh and twelfth thoracic and the first, second, and third lumbar vertebrae,

thus including two healthy ones above and two below the diseased first lumbar. In the lateral view (Fig. 6) the function of the splint in relation to the slight kyphosis is well shown.

A discussion of the symptoms, diagnosis, pathology, and treatment of Pott's disease by the reporter is to be found in *INTERNATIONAL CLINICS*, vol. i, series 24, 1914.

FURTHER INDICATIONS FOR THE SPINAL GRAFT

Fractures.—In certain fresh fractures, and in cases of persistent nonunion that present pain, disability, and increasing deformity.

Spondylitis Traumatica (Kuemmel's Disease).—This produces crushing of the vertebral bodies with progressive kyphosis and ultimate cord-compression.

Vertebral Osteo-arthritis (Charcot's Disease of Spine).—Syphilitic in origin, the vertebrae are compressed and reduced in height and enlarged laterally, and the intervertebral disks are thickened and ossified. In this malady pressure symptoms are liable to arise from the hypertrophic osteitis. If the diagnosis be made early, immobilize and support, and administer antiluetic remedies.

Paralytic Scoliosis.—In very flexible cases, uncontrollable when the trunk is in the vertical position, where there are sharp angular curves, the graft supports the weakened spine and prevents lateral deviation, due to superincumbent weight and unbalanced muscle pull. The graft is inserted into the split tips of the transverse processes on the convex side, including six to eight vertebrae at the greatest point of curvature. In most cases it is supplemented by a supporting spinal brace.

Spina Bifida.—When the meningocele has been controlled and there is a large defect in the spine, together with extreme weakness, as evidenced by lordosis, etc. Here two grafts are inserted, one on each side of the hiatus, and are fixed in by splitting the stumps of the neural arches, while the lower ends are received into the split first segment of the sacrum. The two grafts form an acute angle, like an inverted V.

Tuberculosis of the Sacro-iliac Joint.—When treated by conservative methods the prognosis is most unfavorable, but is better in children than in adults. The graft is the most reliable, as well as the easiest way of giving support. The uppermost spinous process

FIG. 7.



Osteoplasty of spine. Same as preceding figure. Anteroposterior view.

of the sacrum is split horizontally and the posterior surface of the sacrum denuded of periosteum, scarified, and freshened. The mass of the ilium is split and the graft driven in. The other end is fixed by fastening the soft parts over it.

Luxation of the Sacro-iliac Joint.—In severe cases the graft may be used according to the technic just outlined.

THE INLAY BONE-GRAFT IN THE TREATMENT OF FRACTURES

Fresh Fractures.—Since here the osteogenetic function of the fragments is active and only awaits accurate apposition for union to take place rapidly, the temporary fixation required may, in suitable cases, be obtained by the proper application of the Lane plate, provided that reduction and external fixation could not be attained.

In compound fractures metal, as is broadly recognized, is contraindicated, since it favors and maintains infection. Since the graft, on the other hand, has shown germ-resisting properties in the presence of tubercle and of attenuated pyogenic infections, then its reliability and trustworthiness are obvious in compound fractures, which are either not infected or will become infected. The graft stays in *in toto*, or, at the most, a small shell of it comes out.

In *gunshot and comminuted fractures of long bones* the inlay maintains the length of the limb and prevents amputation.

In a case of gunshot fracture of the humerus seen elsewhere, union by the metal-plate method resulted in six inches of shortening.

In compound, comminuted fractures the graft is to be put in immediately.

In 230 compound fractures Pringle operated right away. He found that (a) cleaning operation without internal fixation gave ten per cent. of secondary amputations; and (b) cleaning operation with internal fixation gave two per cent. of secondary amputations. Pringle therefore recommended internal fixation, but by metal. He took out fragments of bone, cleaned them, and put them back, and got union.

This work confirms the stand taken by Dr. Albee, who accomplishes the same thing with the dovetailed inlay.

Ununited Fractures.—In old, ununited fractures a different problem must be faced. In the ends of the fragments, for as far as one and one-half inches in some cases, osteogenetic activity is either markedly diminished or entirely absent. As a consequence, there is

always found marked sclerosis or eburnation. The therapeutic requirements of these pseudo-arthroses are fixation, stimulation of osteogenesis on the part of the fragments, and an osteoconductive scaffold that connects the active bone in each fragment back of the eburnated areas. While the inlay fulfils the whole of these requirements, even growing bone on its own part, yet the Lane plate furnishes but one, and that is temporary fixation, which is the sole requirement in *fresh* fractures. On the other hand, the Lane plate inhibits callus, favors infection, causes absorption and disintegration of bone, and gives too perfect fixation.

Bone Versus Metal Appliances.—Last December Dr. Albee stated that since one year he has not used one grain of metal for internal fixation purposes.

Instead of the plate, he uses the inlay bone-graft. For metal wire he substitutes heavy kangaroo-tendon, which is just as efficient. If pressure be placed upon metal wire in bone, it very rapidly cuts through. Kangaroo-tendon, being an animal membrane, does not cut through, and is not absorbed before forty days. Even later than this, cutting down upon the tendon in a certain case, it was found to be fully embedded, and pulled out with difficulty. Instead of screws, nails, or spikes, he fashions pegs from a piece of bone with the surgical lathe.

Technic of the Inlay Method.—The reporter had the good fortune of seeing Dr. Albee “inlay” a fractured tibia at the Plainfield Hospital, and of assisting him in a similar case at the Polyclinic Hospital, Philadelphia, on the first of March. The following is a description of his procedure at that time in these cases (Fig. 7 A):

After painting the skin with iodine and applying a tourniquet above the knee, the fracture was exposed by a generous skin incision, made lateral to the intended site of the inlay. The skin and subcutaneous tissues were retracted. The ends of the fragments were released, developed, and freshened with chisel and mallet. In the one case the slight overlapping was reduced without difficulty, while in the other the sharp and pointed ends were found to be necrotic, and upon their removal good apposition was obtained. The bone-graft was outlined on the antero-internal surface of the tibia by incising the periosteum. It measured four inches in length by one-half inch in breadth, and was marked out on the proximal fragment, because of the smaller amount of osteoporosis on that side of the fracture. Upon the distal fragment an area of the same width, but one-half the length, was outlined. With the motor twin circular saw adjusted to

the same width, the periosteal incisions were continued through the bone cortex to the medullary cavity, saline solution being sprayed upon the revolving saws to prevent the development of excessive heat from friction, with its devitalizing effect upon the peripheral bone-cells. Each segment of bone was released by cutting through its end with the small single saw. Upon removing these pieces of bone the medullary cavity was found filled with newly-formed bone. The fibrous tissue was removed from half the surface of the bone-ends preparatory to inserting bone-chips. With the motor-drill, holes were bored in the cortex on either side of the gutter, slanting inward to the medullary cavity. Two were made through each fragment near its end, one on each side of the gutter; two others were made through each fragment one and one-half inches from its end in a similar manner. Through each pair of holes a heavy strand of kangaroo-tendon was passed. The four-inch bone-graft, which had been placed in normal saline solution, was reversed, so that its fractured end pointed proximally, and was introduced into the gutter in such a manner that two inches were received into the proximal portion of the gutter and two inches into the distal portion, the middle of the bone-graft coinciding with the line of fracture. As it was introduced each strand of kangaroo-tendon was lifted over it, and upon tying these the graft was drawn down firmly into its gutter. The smaller, two-inch piece from the distal fragment was discarded.

In exceptional cases, where much strain falls upon the inlay, this piece is split into convenient sizes for passage through the small end of the motor lathe, which turns out bone-pegs. A drill of corresponding size bores holes through the tibia at the margins of the inlay, and into these the pegs are inserted. When, as in this case, the twin-saw is used, the saw-cuts themselves remove enough bone to permit the inlay to sink into the gutter slightly below the surface of the tibia, thus affording room on the margins of the tibial cut for the boring of the holes and the insertion of the pegs. For ordinary purposes, however, it will be found that the kangaroo-tendon suffices for retention. The inlay does not fall wholly within the medullary cavity, because the latter is filled in with newly-formed bone in these old cases. Enough room is allowed by the saw-cuts to permit the strands of tendon to emerge on each side between the inlay and the gutter-wall.

The skin and subcutaneous tissues were apposed with a continuous interlocking suture of catgut. Dry gauze was placed over the wound, the leg wrapped in compressed cotton sheeting, and a gypsum case applied from the roots of the toes to above the knee. The tourniquet was now removed.

Dr. Albee thus prefers a bloodless field for his work. He never ligates a blood-vessel in these cases, but depends upon the obliteration of dead spaces by suture and the compression of the gypsum case for controlling hemorrhage. The tourniquet is never removed until after the case has been applied.

The technic illustrated by the above cases is that used for ununited fractures where there has been minor loss of substance.

In *fresh fractures*, in which the medullary cavity has not become filled with newly-formed bone and there is nothing to prevent the inlay from slipping into it, as would be the case if the twin-saw were used throughout, a slight variation in the cutting of the graft must be made. The removal of both pieces is begun as above, by making parallel saw-cuts with the twin-saw, the difference being that this time the blades cut to a depth only of $\frac{1}{32}$ to $\frac{1}{16}$ inch, the purpose being to outline a graft of uniform width throughout its whole extent. These parallel saw-cuts are then continued through the cortex to the medullary cavity with the *single motor-saw*, held at such an angle as to cause the cuts to converge in approaching the medullary cavity, in order to prevent the graft, when pressed tightly into position, from slipping into the latter.

In *comminuted fractures*, where there is a space to be spanned and the length of the limb is to be maintained by the inlay, it is best to tongue-and-groove the ends of the graft and the tibia at the ends of the gutter (Fig. 7 B). The groove should be in each end of the graft, and the tongue in each end of the gutter. Any tendency to shortening of the limb by muscular pull causes the tongue-and-groove joints to become so much the more firmly locked. However small, the graft in time hypertrophies, under the action of Wolff's law, so that eventually it becomes the size and strength of the bone whose substance it is supplying. In these cases, of course, the graft cannot be obtained from the fractured bone itself, but must be taken from the tibia. The bone that has been removed in shaping the tongue and groove, as well as other bone-fragments, is finely chipped with a rongeur, and pushed between and placed about the ends of the fragments at the line of fracture, and in other crevices that may exist. In this type of fracture the comminuted fragments themselves should be saved and used for this purpose. Such bits act most effectively as supplementary foci of osteogenesis.

In the case of small bones, such as the radius or ulna, the encircling of the fragments with the kangaroo-tendon, instead of boring holes for the latter, inserting pegs, etc., suffices to hold the inlay firmly in place. In the case of the large bones, such as the femur, the graft must be at least five or six inches long, and as broad as the diameter of the bone will permit. Again, the more desperate the case and the more frequently it has been unsuccessfully operated upon, the longer must be the inlay. Proximity to a joint interferes in no way with the success of the inlay. For example, in fracture of the tibia just above the ankle the malleolus may be grooved even to its tip. The limb should in every case be firmly immobilized in as near a neutral

FIG. 7 B.



FIG. 7 A.



FIG. 7 C.



FIG. 7 A.—Tibia showing inlay bone-graft operation as performed for old, ununited fracture, according to description in text. The small graft is placed on the left. Just above is a gutter left after removing an angular bone-graft, which has been inserted into the split cervico-thoracic spines on the right of Fig. 7 C. On the popliteal aspect of the tibia there is shown a bone-peg made by the lathe.

FIG. 7 B.—Tibia showing inlay bone-graft operation as performed for comminuted fractures. The bone-graft was taken from the opposite tibia. Tongue-and-groove joints were made, and bone-chips inserted in the plane of fracture, which here is oblique.

FIG. 7 C.—These specimens were prepared by the writer from anatomic material.

FIG. 8.



Disjunction of upper epiphysis of humerus with characteristic displacement. Anteroposterior view.

position as possible; that is, a posture of the limb which causes the relaxation of those muscles which tend to displace the fracture.

In addition to the mechanical and biological advantages of the bone-graft, each structural layer of the latter is brought into close apposition with its corresponding layer in the recipient fragment; namely, periosteum to periosteum, cortex to cortex, endosteum to endosteum, and medullary substance to medullary substance.

Of the cases of ununited fracture Dr. Albee has operated upon by the inlay-graft method, nearly fifty per cent. had been plated previously. In citing statistics of 450 fractures gathered at the Cook County Hospital, Thomas found that it had been necessary to remove the Lane plates on account of suppuration or other causes in forty-eight per cent. of the cases that had been plated. With the inlay-graft method, on the other hand, 100 per cent. of successes have been secured.

There was seen in a ward walk at the Post-Graduate a patient with a fracture of the tibia, which had been Lane-plated previously. Skiagram showed the fragments to be in good position, but without any union. A six-inch inlay had been used, without pegs. Half of the fibrous tissue was removed from between the bones, and bone-chips were put into this space.

SYSTEMATIC DISCUSSION OF THE SKELETON BY DR. ALBEE

In order to gain some idea of the extent to which the use of the bone-graft is applicable, as well as of his general orthopædic work, Dr. Albee was requested by the reporter to discuss the skeleton in systematic manner from head to foot.

Head.—After nerve-resection for neuralgia, bone-pegs may be used to effect a permanent closure of the foramina (Kanavel). Bone-grafts are employed to correct congenital or acquired deformities of the face, and to replace or repair defects of the mandible. For deformities of the nose, a graft may be contacted with the nasal bones. If the skin incision is made in the tip of the nose, the scar is not noticeable (Carter). After the mastoid operation, a button of bone may be removed from the tibial malleolus to restore the prominence of the mastoid process.

Upper Extremity: Clavicle.—In fractures, in order to prevent deformity from fragments that cannot be controlled by mechanical means, an inlay-graft may be placed in the superior surface.

Shoulder-joint: Disjunction of Upper Epiphysis of Humerus.—

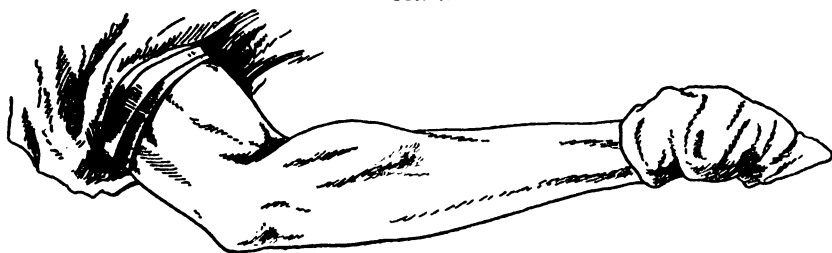
Due to falls on the shoulder, this injury is most frequently met with between the ages of ten and eighteen. The symptoms are swelling, localized pain, wincing tenderness, limitation of abduction, muscular spasm, muffled crepitus, and displacement of the shaft forward and inward, with a characteristic wrinkling where its upper end projects into the skin. The external rotators abduct and, acting together, pull the epiphysis into the horizontal plane and forward (Fig. 8). Maintenance of reduction by conventional methods is most difficult, because the upper end of the lower fragment is in contact with the slippery head and slippery upper metaphysis, and traction is fruitless because there are no connections between the upper and the lower fragment. For these reasons, Dr. Albee proposed bringing the lower into alignment with the upper fragment, which is analogous to the treatment of subtrochanteric fracture of the femur. The arm is elevated anteriorly to the horizontal plane, and the humerus rotated inward, a position similar to that one takes when defending himself from blows. Thus the powerful prehensile muscles attached to the shaft are relaxed—the pectoralis major, the biceps, the coracobrachialis, the strongest part of the deltoid, as well as the supraspinatus and the subscapularis. The position is maintained by a plaster-of-Paris spica. The method is also applicable for fractures in the region of the anatomical neck, and high or low in the surgical neck. Differentiation from luxation is established by determining the presence of the head of the humerus in the glenoid cavity.

Recurrent Luxation of Shoulder.—Because of the disproportion in size between the large humeral head and the small glenoid cavity, as well as the thin, flexible capsule and the frequent exposure of this joint to trauma, luxation is frequent, with a ratio to all luxations of about 43.5 per cent. The same factors, together with weakening of the joint by laceration of its supports at the time of the first luxation, predispose to recurrent luxations. Non-operative treatment has been very unsatisfactory. Operations, such as arthrodesis and resection, are not to be considered. Dr. Albee employs his modification of Burrell and Lovett's capsule-reefing operation with success.

An incision is made from the coracoid process along the deltopectoral groove to the insertion of the deltoid muscle, exposing the

capsule at its antero-internal portion. With a curved needle, sutures of No. 1 catgut are inserted through the base of this fold of capsule, and between them an elliptical piece one inch long and one-half inch wide is excised. Upon tying these sutures it is found that the capsule is distinctly shortened. The muscles fall into place on bringing the arm to the side, and it is only necessary to suture the subcutaneous tissues and the skin. The arm is held to the side with a plaster shoulder-cap. The weight of the arm is taken up by a tight sling applied to the elbow and forearm. It is thus retained for two weeks, when the shoulder-cap is removed. The sling is allowed to remain a week longer, with passive exercises twice a day. At the end of three weeks all apparatus is removed, and the patient encouraged to perform both active and passive exercises.

FIG. 9.



Deformity in fracture of shaft of ulna with anterior luxation of head of radius.

Humerus.—In intra-articular fracture-luxation the head of the humerus should be replaced, at an open operation, as a graft.

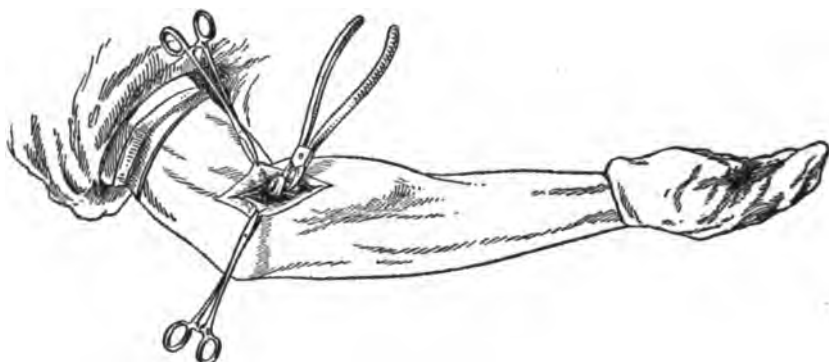
Dr. Albee considers the intramedullary splint as mechanically and biologically imperfect, and cited the following case:

A patient received a fracture of the humerus at the junction of the upper with the middle third, and went five and one-half years without union. One year ago an intramedullary bone-splint was inserted without success. The patient has now a pseudarthrosis.

Forearm: Fracture of Ulna with Luxation of Head of Radius.—According to Ashhurst, this combined injury is more frequent than fracture at the junction of the upper with the middle third of the ulna alone. This was an old case, and the deformity is shown in Fig. 9. Through a small, vertical incision beginning above at the external epicondyle of the humerus the head of the radius was resected (Fig. 10). Through a slightly longer incision at the site of fracture

the fragments of the ulna were separated with the osteotome and mallet and straightened (Fig. 11). The skin-edges were apposed by a clove-hitch continuous suture. A gypsum case was applied with the

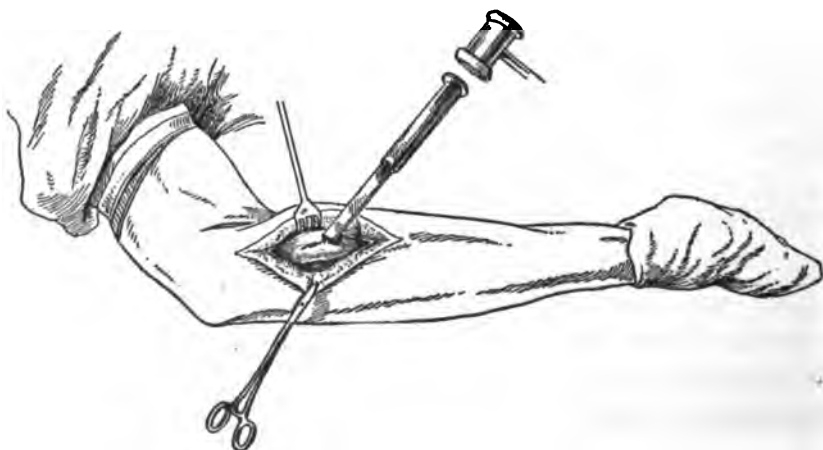
FIG. 10.



Incision exposing head of radius, showing resection of latter.

forearm in the Albee position, that of acute flexion and semi-pronation (Fig. 12). Thus the stump of the radius is retained in place by impinging against the anterior surface of the humerus. It

FIG. 11.



Incision exposing site of fracture, showing separation of fragments.

thus produces strong traction and straightens the ulna, while the acute flexion tends to separate the fragments of the ulna, especially the upper, from the radius. The dressing was left on for four weeks.

Congenital Absence of Radius.—The valgus was so marked that whenever the flexors or the extensors of the wrist contracted the hand was abducted until it contacted with the upper arm. At operation a radial incision was made between the flexors and the extensors. A complete radius, even to the head and broad, lower end, was patterned from the tibia, part of whose upper epiphyseal cartilage was included to insure further growth. This graft was inserted into the bed that had been prepared for it, and the wound closed.

FIG. 12.



Forearm dressed in gypsum sling in Albee's position.

Paralytic Wrist-drop.—In these cases the object is to maintain the hand in the neutral position, to counteract the unopposed pull of the flexor muscles. A bone-graft from the tibia is inserted into the dorsum of the lower end of the radius and of the os magnum, thereby immobilizing the wrist-joint.

Tuberculosis of the Wrist-joint.—The same technic may be employed in suitable cases of this affection.

Hand: Dactylitis.—When *luetica*, the skiagram shows the picture

of proliferative osteoperiostitis, and there is a gnawed appearance at the sides. When *tuberculous*, the skiagram shows intense rarefaction, and a cystic appearance. For the latter variety, in adults and in severe cases in older children, after the diseased bone has been removed, replace with bone-graft.

Lower Extremity: Hip: Osteo-arthritis, Hypertrophic (Morbus Coxæ Senilis).—This obstinate affection has its incipency at an earlier age than is usually conceded, the cases in this series having varied from fifteen up to sixty-seven. In most cases there is the history of an antecedent fall upon the hip affected. The patients have difficulty walking just after rising from a sitting position; it is hard to cross the diseased limb over the sound one; difficulty is experienced leaning over to fasten the shoes, and there is a varying degree of "sciatica." In advanced cases there is deformity in flexion and in adduction, and moderate wasting of the thigh muscles from limitation of motion. Skiagram reveals wearing away of the femoral head and acetabulum, eburnation, and osteophytes. Hygiene, rest, and brace treatment fail to relieve a large number of advanced, progressive cases. Resection of the upper extremity of the femur, as practised by Hoffa and others, gave very unsatisfactory results. In view of the pathology, the operative indications seem to be to secure an immediate firm ankylosis, and in order to compensate for the existing practical shortening, to place the limb in a position of slight over-correction of the deformity.

The hip-joint is exposed through an anterior incision. Osteophytes are pushed aside, not being removed because of their bone-producing possibilities. The portion of the acetabulum that overhangs the femoral head is thoroughly removed: this exposes the head and facilitates the removal of its upper part. With the head of the femur *in situ*, approximately one-half of its upper hemisphere is removed with a large chisel, through a plane nearly parallel with the long axis of the neck of the femur. This fragment is then split at right angles to its cut surface with an osteotome into segments, two-thirds of an inch in thickness. After the removal of the upper part of the head the femur is strongly rotated outward, and all the cartilage that can be reached on the anterior aspect of the remaining portion of the head is removed with a chisel. Then the same instrument is inserted between the head and the acetabulum, and the

cartilage on the contiguous surface of the latter is destroyed as much as possible. The limb is immobilized in the slightly over-corrected position by a long spica gypsum bandage. At the end of four weeks the patient may walk with crutches. At the end of five weeks the long spica is changed to a short one. At the end of eleven weeks the latter is removed. The pain disappears immediately after operation.

This operation has the following advantages:

1. It assures bony union by bringing two large bony surfaces into close apposition, and holds them there firmly by the mere correction of the deformity, if one exist, thus eliminating the possibility of a painful joint or a recurrence of the deformity, both of which are probabilities in the event of an operation for mobility. Furthermore, the stiff hip, in the position of fifteen degrees of flexion, with the compensatory movement of the lumbar spine, has proved of very slight annoyance in every case.

2. It produces a minimum amount of bony shortening, which, as well as that already existing, is compensated for by the fixed abduction of the limb.

3. It involves very little cutting of soft tissues, and does not require the luxation of the head from its socket, and thus produces very little postoperative shock, even in the aged.

4. A luxation or displacement of the femur, even from weight-bearing, is extremely unlikely immediately after the operation. Therefore, aged patients can be gotten out of bed very early.

The operation is also of use in the following conditions:

1. *Extreme paralysis of both hips and the lumbar spine (dangle hips)*, associated with marked lordosis, where contractures of the fascia lata occur and recur. Here the ankylosing of one hip holds the pelvis upright, corrects the lordosis, and makes bracing much easier.

2. *Dislocations following suppurative arthritis of infancy*, where the head of the femur has become disorganized and has disappeared. In this event, the great trochanter should be mortised into the acetabulum.

3. *Fibrous ankylosis*, where mobilization is not feasible, as a substitute for Gant's subtrochanteric osteotomy. This precludes two disagreeable sequences of Gant's osteotomy; namely, joint strain and

relapse of the old deformity, by a slow yielding or stretching of the fibrous ankylosis. In other words, it is treating the hip under similar conditions as the knee-joint has been treated for years.

4. *Tuberculous osteo-arthritis in adults*, in selected cases. As a guide in the selection of these cases, the accepted views concerning the eligibility of excision in tubercle of the knee-joint must again be referred to. It should be noted, however, that this procedure is somewhat more permissible in older children than an excision of the knee, (a) because very little of the epiphyseal cartilage is removed, and (b) normally much less growth occurs here than at the lower end of the femur.

Tuberculosis involving the joints in adults must be considered separately from that in children. In the latter, better repair may be had by conservative fixation, and by prevention of weight-bearing when symptoms are acute. And children can afford to spend a longer time in convalescence. Lorenz claims that bony ankylosis is preferable for tuberculosis of the hip-joint in childhood: he applies a short spica and allows the children to get around. This crushes the joint, and ankylosis results. Dr. Albee puts the child in bed with traction until the symptoms are alleviated. He then applies Phelps's traction-brace, which gives good extension and fixation, until rarefaction about the hip has disappeared to such extent that no severe crushing can occur. After this he puts on a short spica and allows function of the limb in order to avoid atrophy from disuse.

The key-note in tuberculosis in childhood is conservatism; in adults, operation.

Dr. Albee referred to a case of fracture of the cervix femoris close to the caput, with overgrowth of bone around the head and neck. Three times the adhesions were broken up under ether elsewhere. Skiagram showed an old union. He performed the immobilizing operation with a good result.

At the Post-Graduate he showed a case of tubercle of the hip-joint with luxation and with disintegration. He immobilized it by the mortising operation, and applied a gypsum case. Three months after the operation there is still no pain on motion.

At the Blythedale Home he demonstrated a child with tubercle of the hip and sinuses. There was no pain, for the joint had been ankylosed by nature. The sinuses are healing under fresh air and forced feeding.

In non-tuberculous osteo-arthritis the head of the femur is eburnated and sclerosed. In tuberculous osteo-arthritis it is softened and rarefied. In the latter one sees the same crushing as in the vertebræ in Pott's disease.

Excision of the hip has no field of usefulness except as a life-saving measure in certain cases of osteomyelitis that impinge upon it. In case the head and neck of the femur have been destroyed, they may be replaced by using the head and neck of the astragalus as the graft (Roberts).

Luxation of Hip, Paralytic and Congenital: Dr. Albee's Arthroplasty.—In the one case the rim of the acetabulum is much worn, and in the other it is shallow by nature. In the former the capsule is much relaxed and the muscles about the hip lengthened. The bloodless method is the preferable treatment. At first Lorenz ruptured the adductors, but he does not do so now, since they help retain the hip after reduction. Dr. Albee applies traction of from ten to twelve pounds for two weeks to stretch the periarticular structures. He then endeavors to reduce with as little trauma as possible. If he does not succeed in reducing the first time, he puts on more traction and tries again. If an old case, he stretches to get full motion, or even does a tenotomy. After reduction the limb is put up in plaster in the frog position of Lorenz, which is maintained for four months. If the acetabular rim is too meagre for retention of the head, operation is indicated.

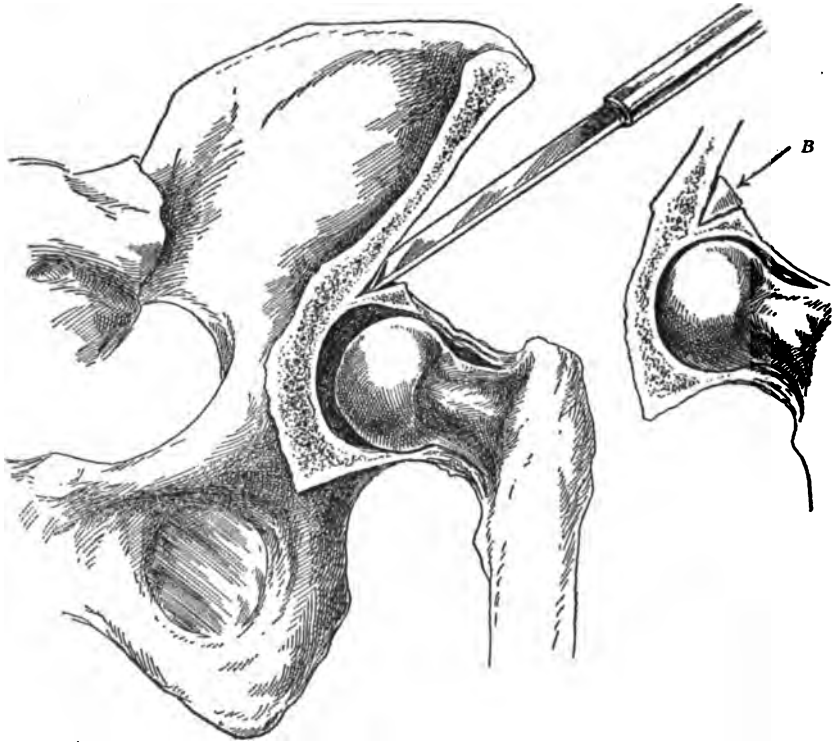
The disadvantages of Hoffa's operation, or deepening the acetabulum by the removal of cartilage and bone, are great, in that it might result in an immediate marked limitation of motion and pain.

The principle of Dr. Albee's arthroplasty is to separate the upper half of the meagre rim of the acetabulum with a chisel (Fig. 13), and to force it downward and outward, thus forming a pronounced rim. The resulting cuneiform cavity is filled with wedge-grafts (Fig. 13, B). The grafts may be taken from the tibia. He has also obtained the grafts from negroes, cadavers, etc., and has even used phalanges from a case of polydactylitis cut up into wedges by the motor-saw. The technic for recurrent luxation is as follows:

Through a lateral incision the upper part of the great trochanter, together with the attached muscles, is separated and reflected upward. The capsule of the superior part of the joint is developed without incising it. With a wide, thin osteotome a broad bone incision, about one-half to two-thirds of an inch above and parallel with the superior edge of the acetabulum, is made obliquely down to the joint-cartilage at a point about the same distance internal to the edge of the acetabulum. With silk sutures a sufficient reef is then made in the postero-superior, or overstretched, part of the capsule, in order to tip down the loosened edge of the acetabulum, and thus hold it in that position so as to form an exaggerated acetabular rim. This opens up a wedge-shaped cavity above the latter by the displacement outward of the bone-fragment. Measures of this cavity are taken with calipers, and wedge bone-grafts are procured either from the tibial crest or from the remaining portion of the great trochanter. If it is necessary to shorten the trochanteric muscles, the grafts are always removed from

the base of the trochanter. When the reflected portion of the trochanter, together with its attached muscles, is replaced, its position is lower by the thickness of the wedge-grafts removed, thus tightening the muscles to that extent. The grafts are drilled and fixed in place by two sutures of medium kangaroo-tendon. Thus the transplant fills the wedge-shaped cavity above the acetabulum while at the same time assisting the shortened capsule in holding the fragment in its new position.

FIG. 13.



Arthroplasty of hip-joint. Separation of upper rim of acetabulum with chisel. B shows insertion of wedge-graft.

This procedure preserves the whole of the joint-cartilage, is not difficult of execution, and fulfils every anatomic requirement.

Dr. Albee showed, at the Post-Graduate, a baby girl, aged four years, who had congenital luxation of both hips (Fig. 14). He reduced the left hip by the bloodless method. A gypsum spica was applied and a skiagram taken. He did not succeed in reducing the right hip at the same sitting, so no gypsum case was put on, in order that the traction could be reapplied.

Osteitis Fibrosa.—This involved the upper end of the femur, and there was marked angulation. The whole area was removed with

the curette, and a strong graft from the tibia was inlaid into the femur above and below the site of removal of the tumor.

Bone Cysts.—These occur more frequently near the slow-growing ends of long bones, as the lower end of the humerus, the upper end of the femur, and the lower end of the tibia. Dr. Albee makes an osteoplastic door with the motor, turns it back on its hinge, carefully avoiding trauma; curettes out the cavity and its lining membrane;

FIG. 14.



Congenital luxation of both hips. Before reduction.

dries it with alcohol, ether, and hot air; fills it with Mosetig-Moorhof's wax, and replaces the door. He also uses bone-chips.

Dr. Albee emphasized the undesirability of traumatizing tissue in bone-work. As regards the skin and the subcutaneous tissue, this occurs unnecessarily by too short an incision and too much retraction, and, in the case of the bone, by the use of the ordinary, too blunt, dull chisel.

Fractures of Femur: Neck.—In children Dr. Albee uses Whitman's method of gypsum case and abduction. In adults, owing to

the mechanical disadvantage of the stress being directly crosswise to the point of fracture, the poor blood-supply, and the sluggish osteogenesis in the joint, union is rendered notoriously difficult, if not impossible. Metal spikes are liable to cause much bone-absorption, with resulting non-union. Therefore, bone-graft pegging should be resorted to in *fresh* as well as ununited cases, and Dr. Charles Scudder, of Boston, endorses this view, stating that he believes it advisable to do it in all non-impacted cases. The technic of this operation is as follows:

The fracture is exposed by an anterior incision, and if necessary the ends of the fragments are freshened by chisel and sharp curette. A point just below the great trochanter is reached by a short, lateral incision. The proper location through the centre of the neck, and the direction of the drill-hole for the peg, are determined by thrusting a small hand-drill through the great trochanter, obliquely upward through the centre of the neck, and into the centre of the fractured end of the proximal (head) fragment, as felt or seen through the anterior incision. This may necessitate the withdrawal and reinsertion of the drill. Upon determining the proper location and direction for the drill-hole, the large motor-driven drill is pushed inward in that direction through the centre of the neck and well into the head. This drill produces a hole six-sixteenths of an inch in diameter. The drill is then disengaged from the motor and left *in situ* to hold the fragments in apposition while the bone-graft is being removed from the tibial crest of the opposite limb. As removed by the motor-saw, the latter measures four inches in length and six-sixteenths to seven-sixteenths in cross-section. The lathe, which turns out a dowel of proper size to fit the drill-hole, is then adjusted into the motor. While the lathe is securely held by an assistant, the bone-graft is slowly fed into it. This is done with comparative speed, and assures a perfect fit. This strong peg is driven home by a metal mallet. The skin is closed without drainage. The limb is secured in the neutral position by a plaster spica.

The peg stimulates callus-formation, and conducts a blood-supply from the spongy great trochanter. Firm union is usually present at the end of six weeks. The causes of bending of Lane's plates and strong spikes in these fractures are, first, that both of these appliances contribute to non-union, so that the patient is liable to bear weight before union has taken place; and, secondly, because the limb was probably not dressed in the neutral position. If the latter condition be fulfilled, neither the bone nor the metal peg can bend or break.

Subtrochanteric.—Because of contraction of the iliopsoas muscle with resulting flexion of the upper fragment, fracture at this site is hard to control without operation. Here, again, the importance of the neutral position is forcefully emphasized. The limb should be

dressed and secured in flexion and abduction, whether operated upon or not.

Middle of Shaft.—Treatment should be conservative at first. In long, oblique fractures of the shaft the mechanical principle of the inlay has its best application *if put on the side of the obliquity*.

Supracondylar.—If above the gastrocnemius, the upper end of the lower fragment is tilted backward into the popliteal space. If below, the muscle exercises the same action upon the lower end of the upper fragment. Therefore, by flexing the leg upon the thigh, thereby relaxing the calf and the hamstring muscles, a natural splint is formed for the fracture.

Dr. Albee referred to a case of supracondylar fracture *above* the gastrocnemius, with the characteristic deformity. The insertion of metal plates elsewhere had failed twice. He found the lower end of the upper fragment in a lake of serosanguineous fluid. After sliding an inlay from the upper fragment down, perfect union was obtained.

Disjunction of Inferior Epiphysis.—Here, also, flex the leg upon the thigh.

Patella: Fracture.—If the middle portion is involved transversely, as is usually the case, prepare a bed for an hour-glass dovetail inlay. Outline the graft on the tibia according to the measurement of the calipers, and cut it off with a small saw. Because of the thickness of the patella, the full thickness of the tibial cortex may be included. The sides of the patellar cut are bevelled in, just enough to place the inlay in its bed. This insures *bony* union, instead of fibrous, which is usually attained by the older methods.

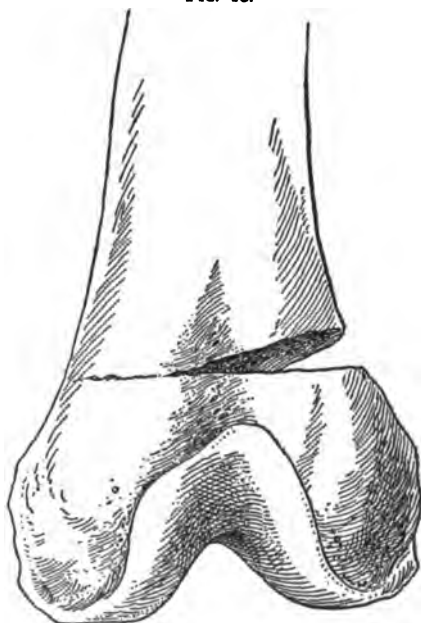
Slipping Patella.—Cartilage is a greater preventative against adhesions than the fascia-fat flap method of Murphy. In this condition the external condyle is too low, and the patella slips over it. The principle of the operation is to split the external condyle and insert bone-wedges behind it, as in arthroplasty of the hip-joint. In certain cases, where the condyle is especially low, it may be necessary to plicate the capsule.

Injury to Semilunar Cartilage.—The meniscus may be luxated, fractured, or teased out from injury. The crucial ligaments may be torn and the tibial spine fractured. In cases in which the diagnosis of injury to the semilunar is questionable, and thus for exploration of the knee-joint, Dr. Albee favors Robert Jones's method of longi-

tudinal splitting of the patella, and states that this method will revolutionize the surgery of the knee-joint.

A female, aged thirty years, was injured in a bicycle accident, her left leg slipping from under her. The knee was swollen. With the diagnosis of damaged internal semilunar cartilage, the joint was explored through an internal and an external incision by another surgeon, who told her nothing could be found. Other men had put on a brace. When Dr. Albee saw her, ten years after the operation, she had become a nervous wreck. He found the symptom-complex of an injured semilunar, which he picked out from her neurasthenic syndrome. Upon splitting the patella vertically by Robert Jones's method he found the

FIG. 15.



Knock-knees. External osteotomy of two-thirds thickness of femur by McGuire's method.

internal semilunar split from end to end, and the inner portion split longitudinally, and, like a jumping-rope, playing back and forth. Removal of the damaged disk cured the neurasthenia.

Dr. Albee also referred to a patient in whom, after making the above-mentioned approach to the knee-joint, he discovered a fracture of the spine of the tibia. He stitched the spine back into place with kangaroo-tendon.

Knock-knees.—The three most frequent sequels of rickets are coxa vara, knock-knees, and bow-legs. For the second Macewen recommended osteotomy of the lower end of the femur on the *inner* side; McGuire, on the outer.

Dr. Albee's patient was two years and eight months of age. He entered the osteotome one finger-breadth above the external condyle, vertically through the skin. Upon reaching the bone he revolved the instrument so as to spread the periosteum, and then cut transversely through two-thirds of the thickness of the femur (Fig. 15), fracturing the remaining third. Since no steps had been taken to control hemorrhage, no stitch was placed in the skin, for if a hæmatoma form, he would prefer to have it discharge into the dressing than retained in the wound. The limbs were maintained in an overcorrected position by a double plaster spica of the groin, and turns from the roots of the toes up to the groin, and a splint-board, crossing transversely beneath the calves, was incorporated into the dressing (Fig. 16). This splint strengthens the limbs, prevents their rotating, and thus lessens the amount of plaster that needs be placed around the waist. The dressing is retained for eight weeks.

FIG. 16.



Knock-knees. Postoperative plaster dressing to maintain limbs in overcorrected position. Note incorporation of splint-board to prevent their rotation.

Non-union never results, since this is in reality a subperiosteal fracture. After fracture of the upper end of the tibia in knock-knees, he inserts a bone-graft wedge into the external surface.

Bow-legs.—For general bow-legs throughout the length of the tibia Dr. Albee uses the osteoclast; and for exaggerated anterior curve of the tibia, the osteotome. Operations for bow-legs are not performed until after from one and one-half to two years of age.

Knee-joint: Ankylosis.—If the knee is fixed in a bent position, Dr. Albee excises a transverse, oval wedge of bone anteriorly from

the femur or from the femorotibial synostosis, turns it a quarter of a revolution, and inlays it vertically, after straightening the limb.

Tuberculosis of the Knee-joint: Erasion with Bone-transplantation.—That poor results follow excision is shown by the frequency of non-union in a series of cases reported from the orthopædic service of the Massachusetts General Hospital. That it is illogical to insert Lane plates into a tubercular process is shown by the fact that two out of eight cases in this series which had been fixed by plates and clamps came to re-excisions, because of insufficiency of the callus that formed. Dr. Albee's method is to perform erasion with removal of the least possible amount of bone, and to immobilize by inlays obtained from the edges of the patella. Firm union usually follows in five weeks. The technic, which is also applicable for the correction of complicating deformities, as fibrous or incomplete bony union, is as follows:

The first step, before entering the tuberculous joint, is to supply the bone-graft. If the patella be not too much involved in the disease, it may be sawed into inlay grafts, which answer the purpose. Otherwise, an eight-inch graft is removed from the antero-internal surface of the tibia by the twin-saw, with the blades adjusted seven-sixteenths of an inch apart. It is then placed in warm saline solution until needed.

An Esmarch constrictor encircles the upper portion of the thigh. A large U-shaped incision is made so that its lowest point is over the tubercle of the tibia. The ligamentum patellæ is divided at its insertion, and the patella is turned upward and removed. The lateral ligaments are cut, and the leg is fully flexed on the thigh. The tuberculous granulations are trimmed away with scissors. With a narrow bow-saw, a thin section (6.35 to 8.46 Mm. in thickness), consisting of the cartilage with the underlying bone, is removed by following a plane that is approximately parallel with the convexity of the femoral condyles. With the same instrument a section is similarly removed from the superior extremity of the tibia, but by a concave cut, so as to produce a surface which will receive the convexity of the lower end of the femur: the bone should be so removed that, when the cut surfaces are approximated, the leg is straight. The anterolateral surfaces of the upper end of the tibia and the lower end of the femur are each exposed for about three inches. On each side of the patellar site the periosteous structures are incised down to the bone, both tibia and femur, parallel with their long axes, and are turned sideways with the periosteal elevator. With the femur and tibia held in good apposition, and with the blades of the twin-saw adjusted to the same distance as before, two parallel cuts are made on each side of the patellar site, each bone being traversed for a length of two inches. The strips of bone are removed with the small, single saw and a narrow chisel. The eight-inch bone-graft is now taken up and divided transversely into equal parts. Each of the four-inch inlays will fit snugly into each gutter on each side of the patellar site. They are retained in place by strands of kangaroo-tendon, according to the technic described for the inlay treatment of fractures.

The following illustrative case was seen during a ward walk at the Post-Graduate Hospital:

A woman, aged twenty-one years, began, in November, 1913, to have sharp pain in the right hip, marked on exertion. This was cured by the application of a plaster spica with rest in bed for nine weeks. Then there began a severe pain in the left knee, which interfered with sleep from the beginning. She has not been able to walk since. At operation, the posterior surface of the patella was removed, and grafts fashioned from the healthy part of the patella were used as inlays. Since the operation there has been no pain.

In tuberculosis of the knee-joint one does not see the same amount of crushing as in the hip-joint and bodies of the vertebræ, because it is too strong.

Deficiencies in Bones of Leg.—The bone-graft method is applicable for cases of congenital absence or acquired deficiency of the tibia, and also for the fibula if the external malleolus does not functionate. When the bone-ends are conical, as after osteomyelitis, split them and insert bone-graft. In favorable cases the long tongue-and-groove inlay method may be used, just as in comminuted fractures.

The following very interesting case, operated upon in November, 1914, was described by Dr. Albee. It has not been published before.

The patient was a child. The right leg showed complete congenital absence of the fibula. The tibia had a marked anterior curve. The foot was displaced upon the outer side of the lower end of the tibia, the weight being borne upon the internal malleolus. The left leg showed a mere conical stump, in which a rudiment of the tibia and two small tarsal bones could be distinguished: it was surmounted by a toe-nail. The stump was trimmed up, and the rudimentary tibia, which was strong and large, was transplanted to the right leg and secured to the lower end of the tibia in such a manner as to form an external malleolus.

Cases of congenital absence of the fibula were reported in the *British Journal of Surgery*. Corner, of London, and Hay Groves, of Bristol, discussed their rarity, but did not suggest treatment.

Tuberculosis of Tarsus.—Rogers, of Boston, collected the statistics in adults, and recommended early amputation on account of poor results. Dr. Albee's experience confirms that of Rogers. A severe case in a man, aged twenty-four years, was operated upon by him as follows:

An incision was made over the internal cuneiform; another, over the tibial malleolus; and the third, over the internal surface of the posterior part of the os calcis. With a broad ligament clamp he tunnelled through subcutaneously

and, pushing grafts previously obtained from the tibia through the tunnels, turned periosteal flaps over their ends. Through short incisions over the fibular malleolus and the cuboid he inserted a graft by the same procedure, thus obtaining immobilization of the tarsus. A gypsum case was then applied.

This patient had been in bed in another hospital for weeks with a closely applied gypsum case on the tarsus, yet he had pain from muscular spasm. After the grafts were applied this pain disappeared, because the tarsus was fixed. Despite their contamination through opening into tuberculous pockets, these bone-grafts grew in. The tarsal tuberculosis was cured, but a bad surgical kidney developed. The resistance was not great enough to protect him from infection, *yet the tarsus healed.*

Malleolar Fractures.—In these, as well as in fractures of the lower third of the tibia, when ununited or united in bad position, insert bone-graft-peg instead of metal nail. In the case of a bad malleolar fracture, run the inlay to the tip of the malleolus, in the shell of the latter, thus forming a new malleolus, as mentioned above when dealing with the inlay treatment of fractures.

Fracture of Os Calcis.—In falls from a height this bone breaks sooner than the astragalus, a battering-ram mechanism being operative. The line of fracture may be through the body of the os calcis with obliteration of its arch, or from its posterior portion a block of bone may be impacted into its body, thus diminishing the arch. In the latter case the treatment is conservative. In the previous case perform tenotomy of tendo achillis, with foot in equinus position. Control the fragment by strapping, or by a Codivilla nail driven through the os calcis to hold the posterior fragment down, and thus restore the arch.

The astragalus may be driven down into a comminuted os calcis. The displacement separates a fragment posteriorly, like a sudden impact into a semi-solid mass. The posterior part of the os calcis is driven down and the anterior part elevated, and dorsiflexion of the foot is obliterated.

Club-foot: Congenital.—If in an infant and mild, stretch forcibly, strap with adhesive plaster, and five weeks later apply a gypsum case with foot in overcorrection, thus correcting the *varus*. Leave the *equinus* to be corrected by tenotomy of the tendo achillis later. Operation should not be performed until after from two to three years of age, when ossification has occurred. The soft-tissue operations of Phelps are followed by many recurrences. In severer, old,

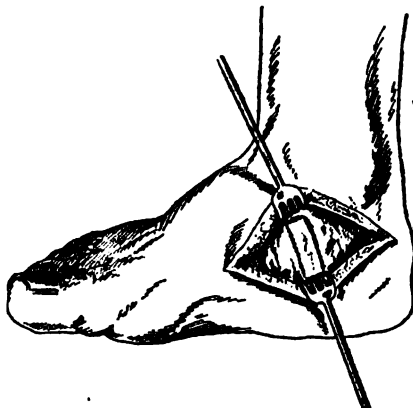
and relapsing cases, when the tarsus resists correction by tenotomies and wrenchings, it is remodelled by removing a wedge from the outer, longer, convex border of the tarsus, usually from the cuboid (Fig. 17), and inserting it into the inner, shorter, concave border at the point of its greatest concavity, the scaphoid bone, which is split to receive it (Fig. 18). Where the foot is longer, the varus less marked, and the cuboid less hypertrophied, the bone-graft is taken from the crest of the tibia of the opposite leg. The technic in the latter instance suffices to illustrate both methods.

FIG. 17.



Congenital club-foot. Wedge removed from cuboid.

FIG. 18.

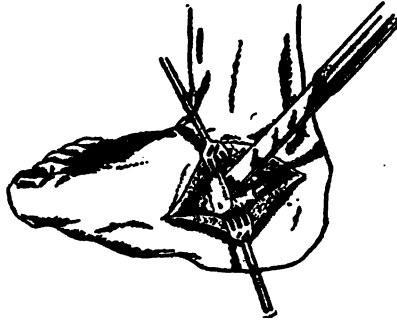


Congenital club-foot. Wedge removed from cuboid inserted into split scaphoid.

In addition to preparing the deformed foot for operation, both legs are also prepared at the same time. A subcutaneous tenotomy of the tendo achillis is done, and the equinus deformity corrected. It is important that the heel be thoroughly brought down, using the foot as a lever over the lower end of the tibia. With the foot on a sand-bag, a U-shaped incision, sufficient to expose the inner aspect of the scaphoid, is made, and a flap of skin and subcutaneous tissue turned back. The scaphoid is split into anterior and posterior halves with a sharp osteotome (Fig. 19). The correction of the adduction and varus deformities is accomplished by the forced separation and readjustment of the planes of the scaphoidal halves. While an assistant holds the foot in strong overcorrection, the distance between the scaphoidal halves is determined by calipers. The wound in the foot is then packed with saline compresses. The crest of the tibia of the other leg is now exposed below the tubercle, and with a scalpel a wedge-graft is outlined on the periosteum one-eighth to one-fourth of an inch thicker than the caliper measurement of the scaphoidal cavity. With the small motor-saw, cuts are made along the periosteal incision through the

bone cortex. Before disengaging the graft from its bed, drill-holes are made in its centre with the motor-drill. The graft is then removed by wedging a thin, narrow osteotome into the saw-cuts, and is threaded on a strand of medium kangaroo-tendon, each end of which is threaded into a strong cervix-needle. One needle is forced through the anterior half of the scaphoid from the side of the cut surface, and the other through the posterior half in similar manner. In older cases, on account of the density of the bone, a drill may have to be substituted for the needle. The graft-wedge, slightly larger than the cavity in the scaphoid, is forced home between its halves (Fig. 20), thus closing up the tarsal joints which have been forcibly separated anteriorly and posteriorly. The kangaroo-tendon suture is then drawn taut over the graft and tied. The peri-osseous structures are drawn over the inlay and sutured with chromic catgut, and the skin-wound is closed with plain catgut. With the foot overcorrected and the knee flexed to a right angle, a gypsum case is applied from the toes to the groin. At the end of four weeks this is removed, and a second case, applied from the toes to the knee, is left on for the same period.

FIG. 19.



Congenital club-foot. Scaphoid split into anterior and posterior halves with an osteotome.

The advantages of the graft-wedge are, first, that by permanently lengthening the short side of the skeleton of the foot it insures in a most trustworthy way against a relapse of the deformity; secondly, no interference with joint function or mobility is caused, since no joint is involved by the operation.

Acquired (Paralytic Varus).—Here there is hypermobility instead of the stiffness of the congenital variety. The indication is to make the foot more stable, since the muscles are paralyzed and the ligaments overstretched, permitting an abnormal amount of motion in the most mobile joint of the foot, the astragaloscaphoid, and resulting in a flail joint. This type of acquired club-foot is almost always due to unbalancing of the musculature of the foot by paralysis of the peronei, which are abductors of the foot and elevators of its outer border. If these muscles are paralyzed, the foot falls into

adduction and varus, and the child walks on the outer edge of the foot, thus causing exaggeration of adduction and overstretching of the capsule of the astragaloscaphoid joint, so that weight-bearing increases the deformity. In the treatment of this variety there are three conditions to meet: (a) by correcting the deformity; (b) by removing the flail condition and making the foot more stable; and (c) by elevating and holding up the outer border of the foot.

The deformity is corrected by performing an arthrodesis at the astragaloscaphoid joint. After abducting the forefoot, a large, cuneiform cavity is thereby opened up in this joint. This cavity is filled in by a graft-wedge from the tibia, which is prepared and inserted as in the congenital variety described above. Thus the foot is made more stable.

FIG. 20.



Congenital club-foot. Graft-wedge, obtained from cuboid or tibia, inserted between halves of split scaphoid. Correction of deformity shown in outline.

The third indication is met by stretching heavy braided silk ligaments between the fibular malleolus and the posterior part of the cuboid, or better, since silk ligaments might pull out, by making use of the tendons of the paralyzed peroneal muscles as ligaments. In the latter case a door is turned up from the fibular malleolus, hinging upon the periosteum. The synovial sheaths behind the malleolus are incised, and the tendons are slipped forward under the door, which is fastened down and held by sutures. The tendon of the peroneus longus is planted into the outer borders of the foot. The dense tendinous tissue holds better than silk ligaments hold. This use of the peroneal tendons was suggested by Codivilla, and later by Gallié.

Valgus from Infantile Palsy of Extensors of Foot.—This operation was witnessed at the Post-Graduate Hospital the day before New Year's.

Tourniquet applied above left knee. Tendo achillis tenotomized because too short. Arthrodesis of astragaloscaphoid joint performed, correcting valgus. The remainder of the operation aimed at preventing toe-drop by utilizing the tendons of the peroneus tertius and tibialis anticus as ligaments. A four-inch vertical incision with its centre over the front of the ankle-joint was made. The anterior annular ligament was cut, and the two tendons drawn one to each side, exposing the anterior surface of the lower end of the tibia (Fig. 21). On the periosteum a rectangular door was marked out with the hinge internally, and the small motor-saw bevelled the door free from the bone. The external tibial edge and the adjacent edge of the door had been previously drilled. The door was now turned inward upon its hinge (Fig. 22). With rongeur forceps bites were taken from the upper and lower edges to accommodate the entering and leaving tendons. The bone-chips thus obtained were inserted later as multiple foci of osteogenesis. Catgut sutures inserted into the tendons opposite the upper and lower tibial edges served, when tied, to take in reefs (Fig. 23). The tendons were buried in the medullary cavity; the door was closed and held shut by a strand of kangaroo-tendon passed through the drill-holes; the cut edges of the anterior annular ligament were stitched together, and the deep fascia and skin edges apposed (Fig. 24). A gypsum case was applied from the roots of the toes to above the knee-joint.

The gypsum case is maintained for a year: it overcorrects the foot in both positions; namely, in extension, and in elevation of the inner border. The tendency to flat-foot is obviated by arthrodesis of the astragaloscaphoid joint. The tendons are fortified by burial in the bone. In the latter so much disturbance was made that a great proliferation of bone will be stirred into activity, and the tendons and bone will amalgamate into one large, bony mass. No brace is needed: in fact, the object is to get rid of braces. A brace is a stigma to the surgeon, because the patient must always wear it. These tendons cannot be transplanted so as to correct the deformity and functionate at the same time. If the peronei be not involved, Dr. Albee performs arthrodesis at the astragaloscaphoid joint, and then transplants the tendons of the peronei, longus and brevis, to the scaphoid, suturing them firmly to the tendon of the tibialis anticus: they are thus transformed from a deforming to a functioning force. These operations are followed by muscle-training.

[The motor used by Dr. Albee, which is a modification of the Hartley-Kenyon model, together with most of the instruments that he devised for it, is shown in Fig. 25, while the apparatus connected and ready for use is seen in Fig. 26. Fig. 27 shows a suitable case for an inlay operation.]

FIG. 21.



Valgus from infantile palsy of extensors of foot. Tendon of peroneus tertius retracted externally, and that of tibialis anticus internally, exposing anterior surface of lower end of tibia. Note cavity left after arthrodesis of astragalo-scaphoid joint.

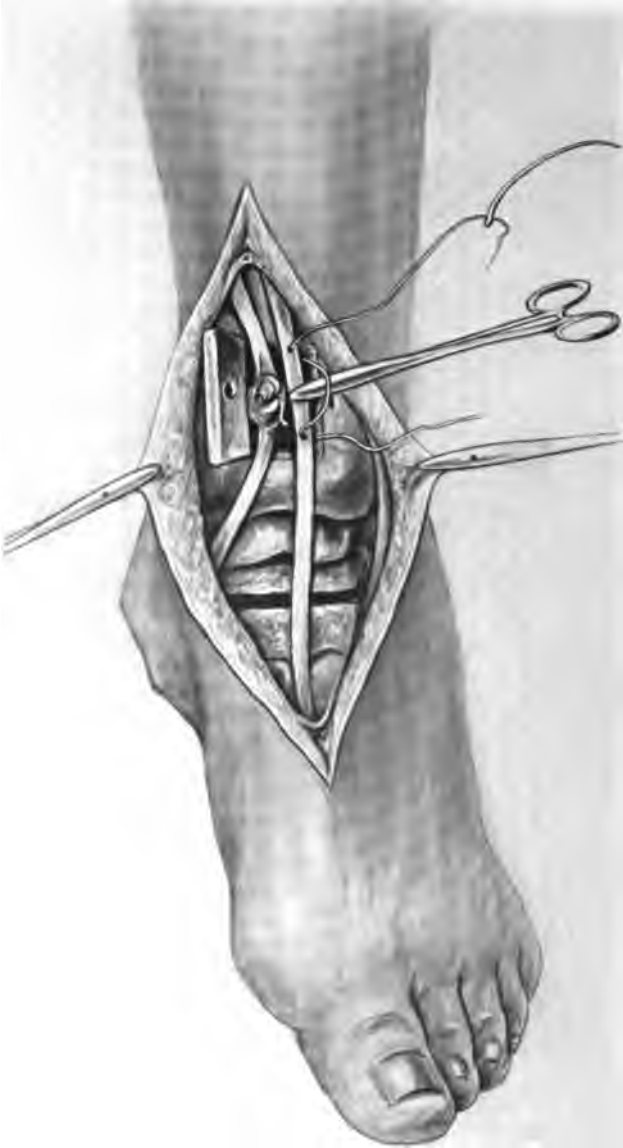
FIG. 22.



Valgus from infantile palsy of extensors of foot. Rectangular door lifted from tibia and rotated inward on internal hinge. The external tibial edge and the adjacent edge of the door had been previously drilled for the retaining kangaroo-tendon suture.

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FIG. 23.



Valgus from infantile palsy of extensors of foot. Catgut sutures, inserted into the tendons opposite the upper and lower tibial edges, serve, when tied, to take in reefs.



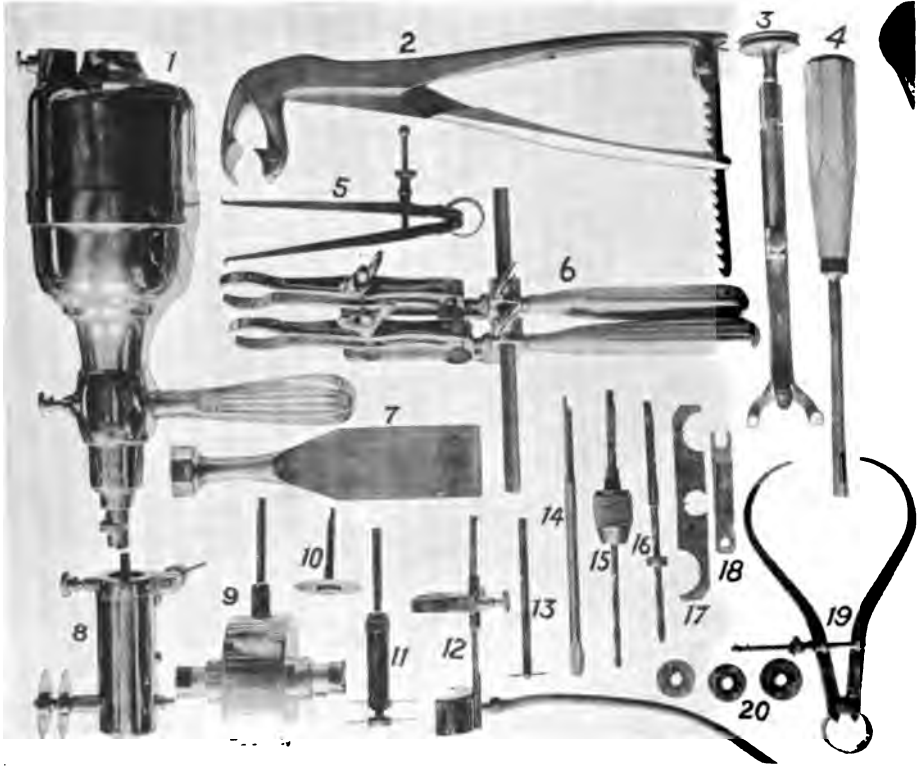
FIG. 24.



Valgus from infantile palsy of extensors of foot. Reefed tendons buried in medullary cavity; door closed and held shut by a strand of kangaroo-tendon passed through drill-holes; cut edges of anterior annular ligament stitched together. Note approximation of astragalus and scaphoid at the site of arthrodesis.

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FIG. 25.



Dr. Albee's electric operating bone set. 1, modification of the Hartley-Kenyon motor, with guide handle attached; 2, Lambotte clamp; 3, Lowman clamp; 4, a carver's gouge, one of several varieties for mortising work on foot; 5, compasses; 6, Berg clamp; 7, Albee osteotome for splitting spines; 8, angular saw; 9, lathe or dowelling mill; 10, male portion of the twin-saw; 11, twin-saw; 12, adjustable guard and spray attachment; 13, small, single saw for releasing inlay at ends; 14, graduated burr for drilling neck of femur; 15, chuck and drill (former permits use of ordinary hardware drill); 16, drill with a guard; 17, combination wrench or twin-saw; 18, wrench for flat end of twin-saw; 19, calipers; 20, guards for graduating depth of saw.

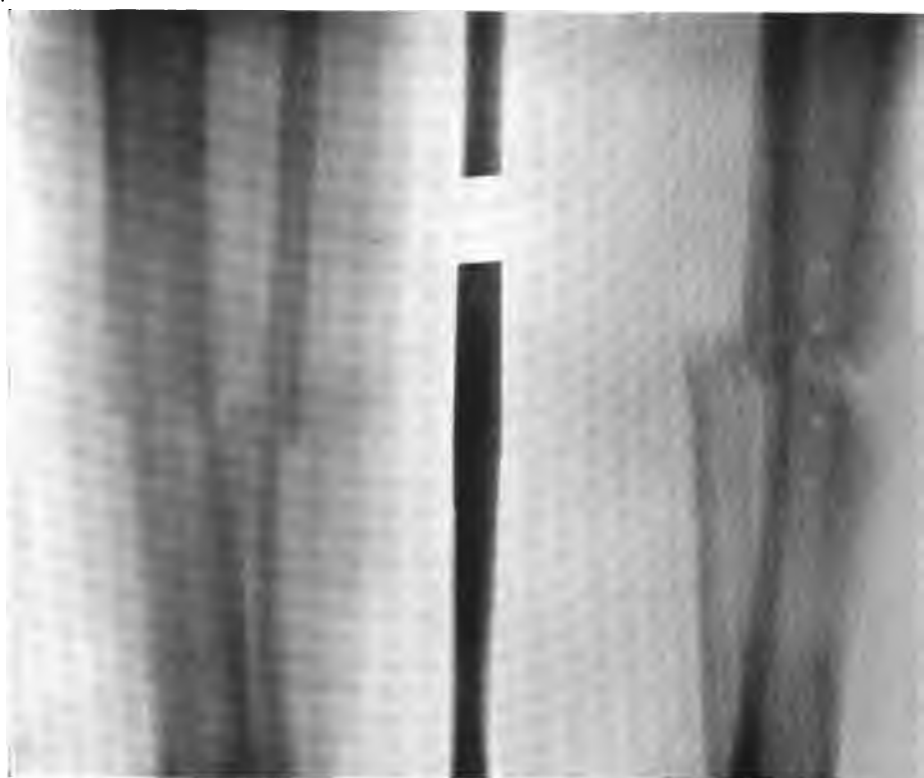
FIG. 26.



Twin-saw ready for use. Shows proper method of holding the motor. Spray attachment and guard connected.

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FIG. 27.



Fracture of tibia and fibula. A Lane plate had been inserted into the tibia elsewhere. This skiagram shows non-union despite perfect apposition secured by the plate. After removal of the latter, and owing to the good apposition, Dr. Albee performed an inlay operation within seventeen minutes.

W. H. U.

GIGANTIC DUODENUM DUE TO KINKING AT DUODENAL JEJUNAL JUNCTION, ASSOCIATED WITH DILATATION OF THE FIRST PORTION OF THE JEJUNUM, GASTRO-ENTEROSTOMY, AND FISTULA FROM THE JEJUNUM INTO THE TRANSVERSE COLON

BY

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THE history of the patient is as follows: Age, forty-eight. Family history negative. Previous personal history negative until May, 1909, when the clinical symptoms of acute perforation of the duodenum occurred. He was operated upon by Dr. Deaver, who found the usual thin, discolored fluid and a perforation upon the posterior wall of the first portion of the duodenum. The perforation was closed by a purse-string suture and a no-loop gastrojejunostomy performed. Following this there was an uneventful recovery and subsequent perfect health for one year. He then developed another attack, resembling a ruptured duodenal ulcer. He was operated upon by Dr. H. Wharton, who found a ruptured duodenal ulcer and dense masses of adhesions. The opening in the duodenum was closed and the wound drained. He again recovered and was able to do his work and remained in moderate health until the latter part of 1910. At that time digestive disturbances appeared, consisting of nausea, vomiting, and distress after eating. These symptoms gradually increased until in March, 1911, when he had a third acute attack similar to the former two. Dr. Deaver again operated upon him and found a thin, grayish fluid, a granular layer covering the peritoneum, very much enlarged mesenteric glands, a small pin-point perforation on the posterior wall of the stomach. The perforation was closed by a purse-string suture, and the wound drained both at the operative wound and by a stab-wound above the pubes. At the operating table a diag-

nosis of tuberculous peritonitis was made. The tests for tuberculosis subsequent to the operation, however, were all negative. He never fully recovered his health. A fecal fistula developed immediately, and several months later a large mass was noted in the centre of his abdomen. Associated with this mass there were frequent attacks of vomiting, sometimes several hours after eating and frequently immediately after eating. There was a gradual loss of weight and strength. In the later months of 1913 he developed a diarrhœa consisting of ten to twenty stools a day of undigested or partially-digested food. On admission the physical signs of value consisted in a tense mass in the upper abdomen which varied in size. Associated with this mass there was a condition of starvation due to the food either being vomited or passed in an undigested condition. He died in August, 1914.

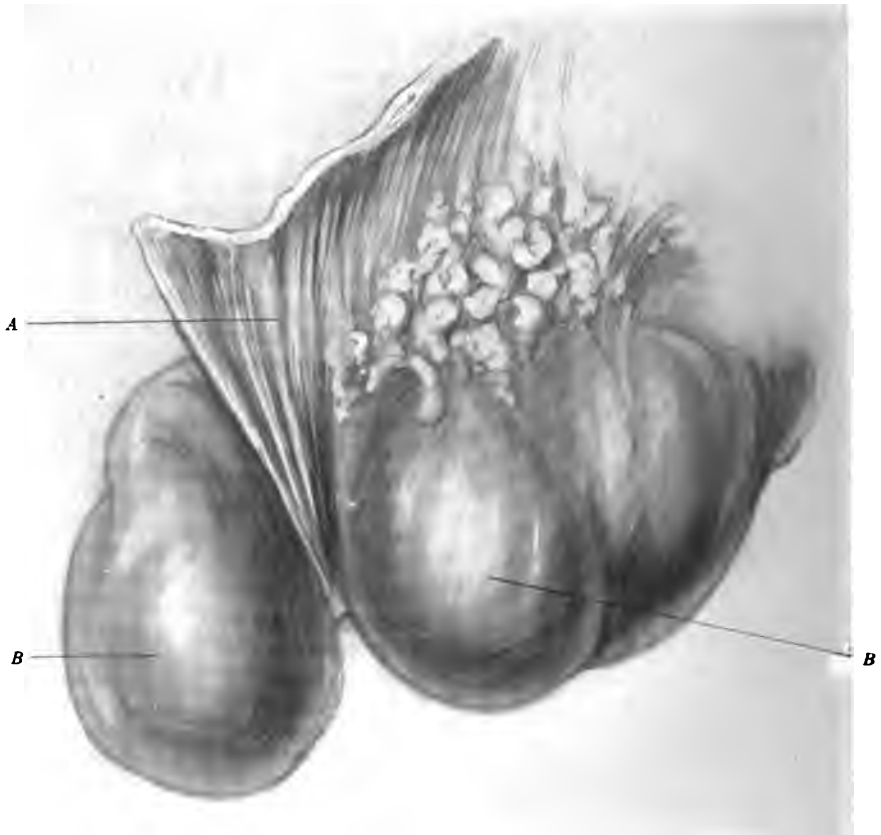
Autopsy.—Only abdominal incision permitted. There were numerous scars on the abdomen, with a small fistulous opening to the right of the umbilicus. On opening the abdomen the peritoneum was clear. There were a few adhesions in the lower abdomen, marked adhesions along the ascending and hepatic colon. There was a large retroperitoneal distention of the second and third portions of the duodenum. It was five or six times the size of a normal stomach. The stomach was slightly enlarged and thickened; the pylorus normal. It easily admitted the middle finger, as seen in Fig. 1. The first four inches of the duodenum were distended to three or four times its normal size, the constriction at the end of the dilatation being caused by the transverse mesocolon and adhesions, as seen in Fig. 2. The second and third portions of the duodenum were dilated into the huge loop, as seen in Figs. 3 and 4. At the junction of the duodenum with the jejunum a marked kinking and slight twist occurred (Fig. 4), the twist being caused by the jejunum being held in place by the gastrojejunostomy. The kinking was caused by adhesions. The more the distention of the duodenum, the more the kinking and subsequent obstruction. The first three inches of the jejunum were dilated, the dilatation being caused by constriction produced by an adhesion, otherwise the small intestines were normal. On opening the anterior wall of the jejunum (Figs. 3 and 4) the gastrojejunostomy opening was seen, and it freely admitted three fingers. Above this opening there was another fistula, leading from

FIG. 1



External fistula in transverse colon. The upper and lower portion of the constricted duodenum. (Dotted lines show complete area of duodenum obscured by the transverse colon and mesentery.)

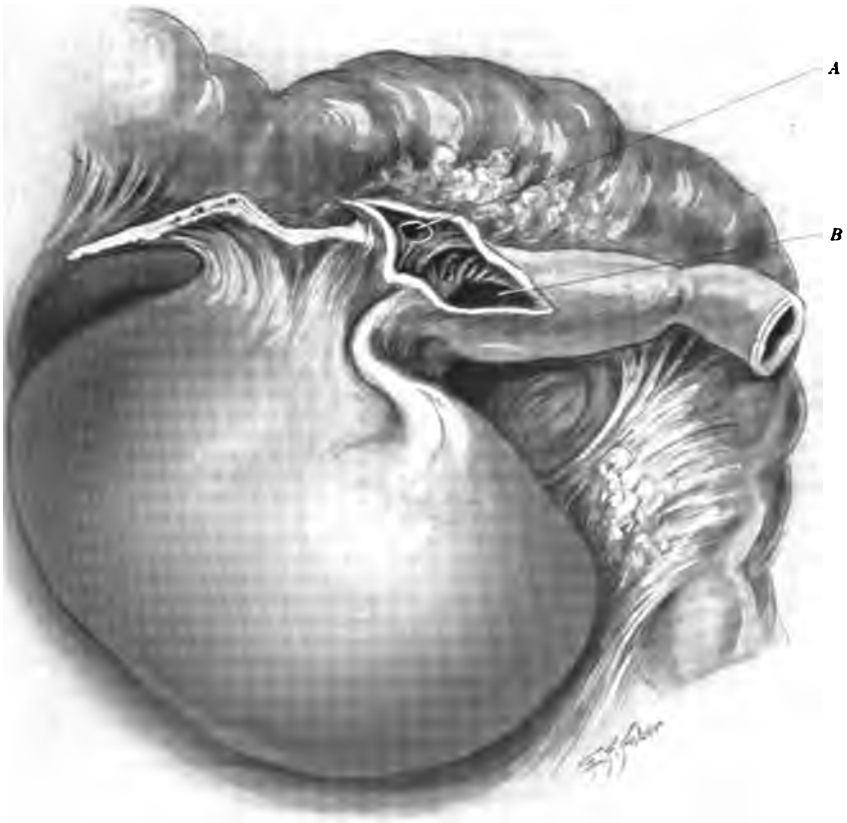
FIG. 2.



A, transverse meso; *B*, dilated duodenum.

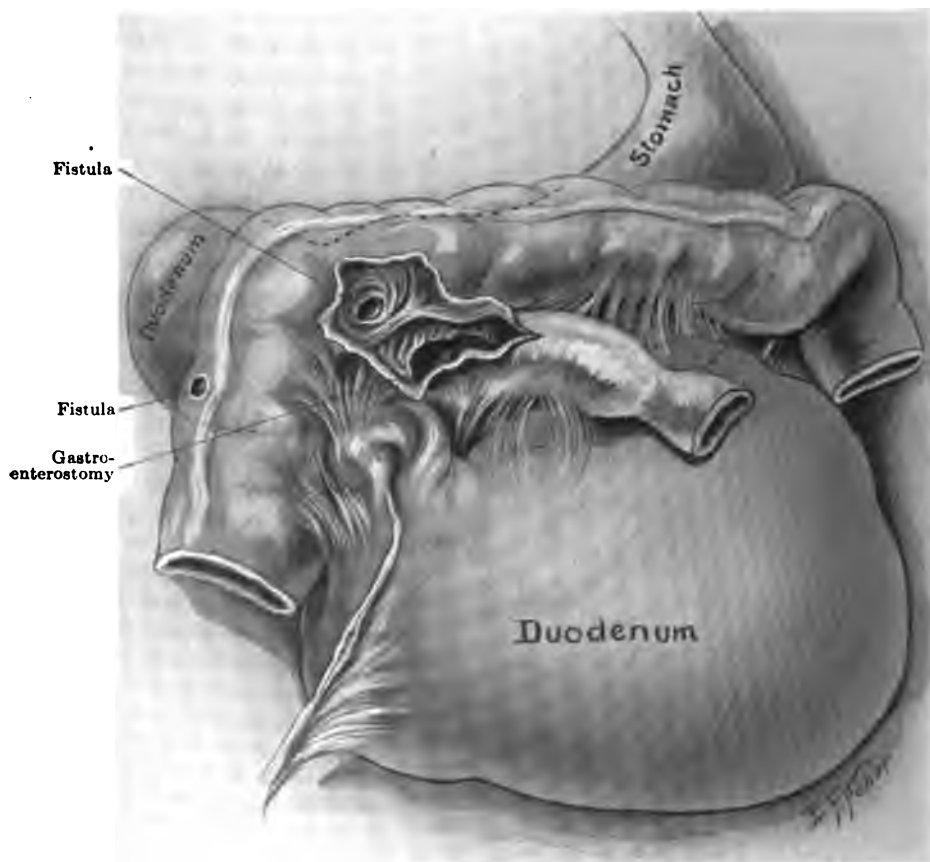
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FIG. 3.



A, fistula from duodenum into large intestine; B, gastro-enterostomy opening.

FIG. 4.



Gigantic duodenum due to kinking at duodenal-jejunal junction.

the jejunum into the transverse colon, which freely admitted the tip of the index-finger. There was a fecal fistula leading from the ascending colon to the abdominal wall. The appendix was normal. The mesenteric glands were slightly enlarged, but there was no evidence of tuberculosis.

We then have a dilated first portion of the duodenum, a gigantic dilatation of the second and third portions, twisting and kinking of duodeno-jejunal junction, dilatation of the first three inches of the jejunum, a wide-open gastrojejunostomy, and a fistula between the jejunum and the transverse colon. The findings in this case were especially interesting, as we had two perforations of the duodenum and one subsequent gastric perforation, the latter two following the gastrojejunostomy.

SOME REMARKS ON GASTRO-INTESTINAL SURGERY AND PATHOLOGY

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I. *Treatment of Rectal Prolapse.*—First of all, before undertaking any operative interference for prolapsus recti or ani, treat the acute or chronic proctitis present, because in the majority of cases this is the principal causal factor of the prolapse. Quite often, particularly in infants and young children, the cure of the proctitis is enough to ensure a cure, but in adults the sphincteric insufficiency or the laxity of the pelvic structures composing the means of fixity of the rectum may have become permanent, and then surgical treatment is required.

In some cases it is indicated to repair the pelvic floor; others—and these the most frequent—will require repair of, or complete change in, the means of the pelvic apparatus of fixity of the rectum: so the problem to be solved is, What portions of the structures of the rectal fixity are insufficient and need repair?

In prolapsus of the first degree there is a laxity of the mesorectum which gives a mobility and the degree of prolapse which can be estimated by the reduction of its pelvic curves, and in these cases rectopexy is proper and colopexy would be without effect.

A prolapsus of the second or third degree, depending upon a relaxation of the mesocolon and the unrolling of the pelvic loop, is the triumph of colopexy with or without colostomy, according to whether or not the proctitis has been rebellious to previous medical treatment. But if the perineal integrity is gone the above treatment will not be enough; the patient must be given a solid pelvic floor and a well-closed anus in order to prevent the proctitis from recurring. Colopexy or rectopexy, combined with perineorrhaphy, should be done in one *séance*, and out of the large number of procedures devised for the latter I shall briefly mention only a few that have some merit.

One of the most original is that described by Schwartz. After reducing the prolapsus, a deep dissection in front of the anus is carried on to the sphincter to the extent of four centimetres in length and two in height. Then the raw surfaces are approximated by four deep silver sutures and four superficial ones of silkworm gut. He insisted on the necessity of bringing the anus far back so that its opening would be in the axis of the rectal ampulla. His technic may be combined with posterior perineorrhaphy, and can be done to complete colopexy or rectopexy.

Another interesting procedure is that devised by Delorme, which consists of a complete perianal incision made at the junction of the mucosa with the skin, and the dissecting out of a cuff of mucous membrane about four or five centimetres in height. This is next divided into two valves and fixed to the anal margin by four U-shaped sutures of heavy silk. Then the valves are resected, and, in the interval of the U-shaped sutures, the mucosa is puckered up and stitched to the skin with fine catgut. A large tube is then placed in the rectum.

A word now as to myrorrhaphy of the levatores ani. A transverse pre-anal incision is made and in the intervagino-rectal line of cleavage the internal borders of the levatores are exposed and approximated by three catgut sutures. The skin incision is closed by silkworm gut without drainage.

I now come to a technic devised by Thiersch, which I think has been neglected by American surgeons, yet deserves to be frequently employed on account of its simplicity in execution and the excellence of the results obtained. The operation acts in two different ways: First, mechanically, by replacing the atonic or destroyed sphincter by a metallic thread, thus exercising a constrictive action on the anus, preventing the exit of the prolapse. At the same time the metallic thread draws upon the insertion of the levatores ani and thus contributes to the consolidation of the perineum. Second, it tends to produce a proliferation of sclerous tissue, resulting in a solid adhesion between the rectum and neighboring structures.

The night before operation the bowels are emptied and a careful toilet of the rectal cavity made with repeated hot irrigations. The entire perineal region should be carefully soaped, shaved, and sterilized, otherwise the success of the operation might be compromised

or even lead to development of very serious complications. The prolapse itself must be carefully cleaned and sterilized.

In children general narcosis is essential, while in adults local anæsthesia is quite enough. This comprises several steps: (1) Anæsthesia by imbibition of the anorectal mucosa with tampons soaked in an anæsthetic solution inserted in the anal canal; (2) injections around the anal circumference and in the sphincter.

The solution for the injections is as follows:

R.—Physiological serum	100 grammes
Novocaine	50 centigrammes
Solution adrenalin, $\frac{1}{1000}$	xv to xx gttæ.

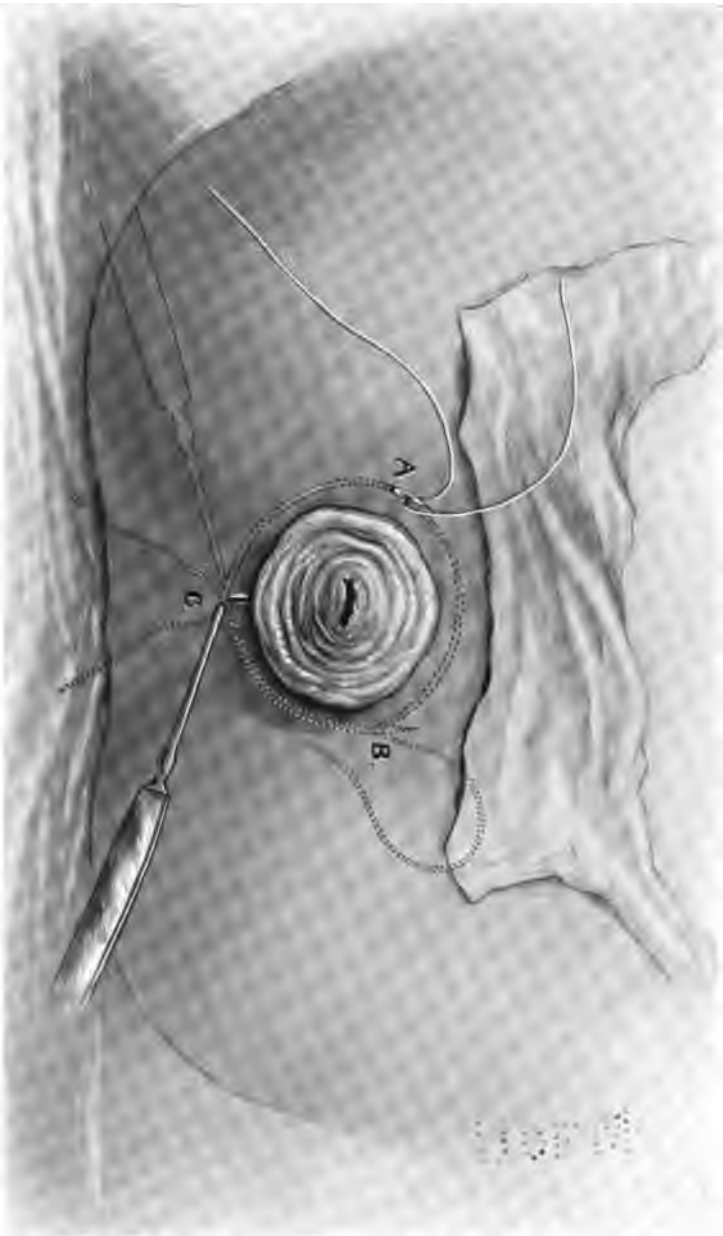
The patient should be placed in an exaggerated lithotomy position, with the pelvis raised high, so that the perineum is freely exposed.

The steps of the operation are carried out as follows: (1) A vertical incision, one centimetre long, in the posterior median line, just back of the mucocutaneous border of the anus. (2) A Doyen's needle inserted in the incision is pushed under the skin and the point made to come out at *A* (see Fig. 1). The wire ligature is inserted in the eye of the needle, which is then withdrawn, bringing out the end of the wire at *C*. (3) The needle is passed through the perianal structures from *B* to *A*, the wire being inserted in its eye and drawn out at *B*. (4) The needle is passed from *C* to *B* and the end of the wire brought out at *C*. A few drops of tincture of iodine are then put on points *A*, *B*, and *C*. (5) An assistant introduces the index-finger, encased in a rubber cot, into the rectum and the wire is tied around it, leaving just enough room to withdraw the finger. The ends of the knot are next cut short and pushed into the incision, the latter being closed by a metallic suture.

The postoperative case is simple. The patient should be constipated with opium and diet for five or six days. Then castor oil is given, and when a desire to go to stool is felt he is given a rectal irrigation of warm sterile water. After this first movement the stools should be procured daily.

The wire should be left *in situ* so long as possible, preferably about a month, but if for any reason it must be withdrawn it can be done in a fortnight. Under local anæsthesia the small incision is reopened,

FIG. 1.



Operation for rectal prolapse. A, B, and C, points of entrance and exit of Doyen's needle for insertion of wire ligatures.

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the ends sought for and cut, and the wire pulled out. Heavy silver wire can be used, but I prefer the bronze-aluminum, as I do not think it cuts the tissues as much.

II. *The Choice of Operation and the After-treatment of Gastric Ulcer.*—In a recent paper published in the *New York Medical Journal*, c, 515–517, 1914, on “The Surgical Treatment of Gastric Ulcer,” I pointed out what I considered the best methods to follow in the management of this lesion, and what will now be said pertains entirely to the choice of operation and after-care necessary.

The many methods which have been recommended during the past twenty years are of unequal merit, and I shall refer only to jejunostomy in gastric ulcer (this operation is not indicated in ulcer of or near the pylorus). Its merits well apply to this lesion, but it is essential that the technic employed be simple, easy, and rapidly executed; the new mouth must be continent.

Simplicity in operation is the basis of good surgery, but jejunostomy, particularly, should be rapidly done, for frequently one operates on a weak subject who cannot withstand a long or complicated interference. The new opening made must be continent,—that is, it must not let the bile and pancreatic juices escape from it, as they are required for proper intestinal digestion; also a reflux of the food introduced should be prevented. Its closure must be perfect, not only at the commencement but during the entire time necessary for a cure of the lesion, and this is a most important quality, because the future of the patient depends on the proper functioning of the jejunal fistula—a condition most difficult to realize.

In jejunostomy for gastric ulcer note that the fistula is only temporary, and after having been used as long as necessary it should close with ease spontaneously, or at least require only an unimportant surgical operation to attain this. When feeding by mouth has at last been taken up, the circulation of the intestinal contents must be perfectly free, without any hindrance at the point where the fistula has closed, so that the latter must not be the occasion of a stricture or a bend in the gut, which would result in serious accidents. The best fistula will clearly be that which is easily made, gives the most satisfaction during the time of its utilization, and will disappear without creating trouble when its services are no longer required.

Simple lateral jejunostomy requires little consideration, as it is probably never done at the present time. Its technic is assuredly the simplest of any, and its performance very rapid. But its serious defect is that the opening is incontinent, and the variations proposed to remedy this defect have been universally unsuccessful. Some, it is true, have given a fistula which was continent at the beginning, but dilatation and secondary incontinence rapidly supervened. Thus the insufficiency of the fistula destroys the great advantage offered by the great operative simplicity of this operation and the absence of gravity.

Simplicity and gravity are certainly wanting in terminal Y-shaped jejunostomy, and, although this procedure is about as perfect as possible from the junctional viewpoint, it is hardly now ever resorted to. The continence of the fistula is durable if the anastomosis is situated sufficiently low down, and, with Souligoux's or Kelling's modifications, one does away with the oozing of the borders of the opening, thus making it a perfectly "comfortable" fistula for the patient. But these advantages are overshadowed by the fact that the operation is long and complicated, necessitating great surgical trauma, and, even when skilfully done, may be detrimental to the patient's recuperative powers. Then when the time comes to close the fistula another rather severe operation is required. It is, however, an excellent procedure when the jejunostomy is to be permanent, as in gastric carcinoma, but it has no place in the operative treatment of ulcer of the stomach, for the reasons already stated. Consequently, one can eliminate lateral jejunostomy because it is too simple and insufficient, and terminal jejunostomy because it is too complicated and severe.

Lateral jejunostomy with anastomosis, which is easier to do than the procedure mentioned, is, however, subject to the same criticism and should not be employed. Lateral jejunostomy with funnel-shaped invagination, as obtained by Fontan's technic, gives an incontinent fistula, and the various modifications which have been suggested to overcome this defect are so complicated and long in execution that in gastric ulcer, at least, they deprive the operation of any value.

There now remain the procedures with canalization. Heidenhain's technic can at once be put aside on account of the dangers it offers. Drucbert's offers more inducements, but is not generally

known to surgeons, although undoubtedly excellent. It takes longer than the Eiselberg-Witzel, of which I am about to speak, and is somewhat more complicated, but it is still sufficiently simple to be used in cases of gastric ulcer. It is simply the application of Mardwedel's procedure of gastrostomy applied to jejunostomy. It cannot, however, satisfy the conditions required as well as the Eiselberg-Witzel to which I now refer.

This operation does not necessitate general narcosis; a simple local anæsthesia amply suffices. It can be done in ten or twelve minutes, and the operative manipulations are reduced to a minimum. In the majority of cases it has given an absolutely continent fistula, provided the technic is closely followed. The fistula has the great advantage of usually closing spontaneously, or at least requiring only a slight operation to attain this end. It has been said that this operation causes intestinal stricture or bends in the gut, and a few cases, it is true, have been recorded, but the stricture was slight and the bend so easily avoided, if vertical suspension of the loop is properly executed, that it is hardly necessary to consider these possible complications. There is no danger from the continued presence of the catheter in the fistula, and the fistula does not close down when the catheter is removed, which can be safely done a few days after the operation and only introduced at each feeding. The simplicity of this operation, the facility of feeding, and the absence of any leakage of bile and reflex of food render it far superior to any other yet devised.

When the operation is completed an ordinary abdominal dressing is applied through which the catheter is brought. This should have been sutured to the abdominal incision to prevent it from slipping out, and is closed by a glass stopper. Jejunal feeding can be commenced at once if conditions require, and the food is better introduced through the catheter by means of a glass syringe. The food should always be maintained at the body temperature, because otherwise it would cause colic, distention, or even diarrhoea. The injection should always be given slowly in order to avoid a sudden painful tension of the portion of the intestine which received the food, likewise to prevent reflux. The first feedings must be given prudently, and one should endeavor to ascertain the susceptibility of the intestine and gradually accustom it to its new function. Thus, in the

beginning, only liquid food, such as milk, beef-tea, bouillon, etc., should be given, as they are easily introduced, rapidly digested, and easily absorbed.

Too much liquid must not be injected at once, because the intestine functionates by successive segments, and one does not open to receive the intestinal contents until the following one is empty. The amount at the beginning should not exceed 150 or 200 Cc. for one meal, but this may be repeated as often as required to obtain sufficient nourishment. By degrees the intestine becomes accustomed to its new functions and will take care of a larger amount of food at each feeding, so that gradually one can give more substantial food and in greater quantity. Usually I have found four feedings a day, of about 250 to 300 Cc. each, will carry the patient along in good condition.

After a time one can add thin vegetable purées, strained soups, meat pulp, and fruit jelly. The food requires no particular preparation; the only important point is to have the solids finely chopped or powdered, so that they can be easily attacked by the digestive juices and rapidly digested. Digestion and absorption are as readily accomplished without the addition of hydrochloric acid or the use of predigested food. As the gastric juice no longer can offer its antiseptic power of defence, the cooking of the food should be careful in order to sterilize it, and it should be of excellent quality. Likewise, a rigorous asepsis of the glass syringe used is of the utmost importance.

The catheter must be left *in situ* for the first ten or twelve days, after which time it can be removed and only introduced at each feeding. If it should be seen that the canal is closing down, the sound may be left in for a day or two.

Nothing should be given by mouth, not even water, during the entire treatment, and the severe thirst at first complained of by the patient will soon subside. The care of the mouth is of great importance, particularly so because the salivary secretion is greatly diminished, and thus buccal infection with extension to the parotid glands by the duct of Stenson is to be feared, but proper attention to details of disinfection of the mouth and teeth will avoid any trouble of this sort.

III. *The Classification of Icteric Syndromes.*—The syndrome of icterus is a most important one in abdominal surgery, so I feel a

classification will be of much use to those working in this field. My conception of the pathogenesis of the icteric syndromes leads me to define icterus in its most general sense as: a syndrome characterized by changes of the normal urinary pigmentation, the blood-serum, stools, and humors in general, accompanied by a more or less yellow color of the skin and mucosa and, according to the case, changes in the blood and various functional disturbances. The essential facts, such as the presence or absence of Gmelin's test applied to the urine and blood-serum; coloration or decoloration of the fæces, logically allow us to classify icterus in three groups: (1) choluric, (2) acholuric, and (3) mixed.

CHOLURIC ICTERUS OR RETENTION ICTERUS.—These correspond to what was formerly called bilipheic icterus, and distinction should be made between an icterus due to extrahepatic retention and one due to intrahepatic retention.

1. Icterus Due to Extrahepatic Retention.—(a) Acute: The icterus of hepatic colic; emotive icterus. (b) Chronic: Cancer of the head of the pancreas; cancer of the choledochus, hepatic duct, Vater's ampulla, and gall-bladder; chronic pancreatitis; congenital or acquired strictures of the choledochus; cancerous lymph-nodes of the hilum; compression from the neoplasms in the neighborhood (peritoneal, gastric, or omental malignant disease); chronic lithiasis of the choledochus.

2. Icterus Due to Intrahepatic Retention.—(a) By compression of the large intrahepatic biliary ducts: Secondary cancer of the liver; hydatid cyst of the liver; abscess of the liver. (b) By disordination of the hepatic structures: During the toxi-infectious states (catarrhal or mild infectious icterus, icterus gravior). (c) By solution of continuity between the hepatic cells and the excretory biliary canaliculus: During the cirrhoses. (d) By biliary blockage (biliary mud-pleiochromic icterus).

In all these cases of icterus Gmelin's reaction is positive in the urine, there is a varying amount of bilirubin in the blood-serum, total or partial decoloration of the fæces, distinct signs of biliary impregnation, on increase of the globular resistance and of the diameter of the red blood-corpuscles. The recent studies on cholesterinæmia have shown that this group of icterus the quantity of the latter is increased.

ACHOLURIC OR HÆMOLYTIC ICTERUS.—These correspond to what was called hæmapheic icterus, and may be logically divided into three groups: (1) Icterus due to blood changes; (2) to splenic syndromes, and (3) to infectious and parasitic causes and the intoxications.

1. Icterus Due to Blood Changes.—(a) Acute congenital type: Icterus of the newly born, or icterogenous erythrodermy (from globular fragility). (b) Chronic congenital type: Congenital hæmolytic icterus (from globular fragility). (c) Acquired type: During the various anæmias.

This group also includes the simple chronic icterus, an exaggerated type of Gilbert's physiologic acholuric icterus, described under the name of familial cholæmia, in its purely hæmolytic form.

2. Icterus Resulting from Splenic Syndromes.—The icteric form of myeloid leukæmia; the icterus arising during Banti's disease; hæmolyzing and icterigenous splenomegalies (from hæmolysins of splenic origin).

3. Icterus Arising in Infectious or Parasitic Diseases and the Intoxications.—(a) In infectious diseases: Syphilis, pneumonia, typhoid, scarlet fever, streptococcic infection, colon bacillus infection, gastro-intestinal infection, and tuberculosis. (b) In parasitic diseases: Malaria, ankylostomiasis, anæmia from tape-worm. (c) In the intoxications: Postnarcosis icterus (chloroformic); lead poisoning.

All these are hæmolysinic icterus. In these Gmelin's test is negative in the urine, but Gübler's test is positive. Urobilinuria is common. The blood-serum contains other pigments besides bilirubin. The fæces remain colored. There is no evidence of biliary impregnation. The icteric hue is very variable in intensity. The hæmatologic characters vary greatly: diminution of the globular resistance in some (icterus from globular fragility); the presence of hæmolysins in other cases (hæmolysinic icterus). A decrease in the diameter of the red blood-cells is also found, along with the presence of granular blood-cells (myeloid reaction) in the majority of cases, and hypocholesterinæmia. With the exception of the icterogenous erythrodermy of the newly-born, Mongour has applied the name of pseudo-icteric xanthodermies.

MIXED ICTERUS.—(a) From hæmolysis due to biliary salts at the

end of choloric icterus. (b) Choloria and acholoria during the evolution of certain cirrheses.

Leaving aside the last class of mixed icterus, the icteric syndromes are divided into two large groups: choloric icterus and acholoric icterus, each having its own distinct characters.

IV. *Acute Colo-colic Invagination in Children*.—Intestinal invagination is, above all, met with in children. It may be either acute or chronic, but in the child it is acute in 98 per cent. of cases. Usually the commencement is sudden, and generally the invagination gives rise to symptoms of acute intestinal occlusion. Sometimes the pain is localized, but more frequently extends over the abdomen and is extremely sharp. At the same time, the belly becomes distended and abundant vomiting occurs, provoked upon the slightest movement, or it may be spontaneous, occurring without the slightest effort. In color the vomitus is greenish. The fæces are soon completely suppressed, and even gas is not passed. In the second stage of the process absolutely typical symptoms appear which are necessary to know in order to formulate a correct diagnosis. There are: (1) The passage of bloody mucus, which is rarely, if ever, absent, and sometimes has a fishy odor; (2) the presence of an abdominal tumor felt by palpation.

I have already referred to abdominal distention, but I would here remark that this may be very slight, or the abdominal parietes are even flat and soft to the exploring hand. In many cases it is possible, by palpation, to find a tumor in the large intestine formed by the invaginated portion. By rectal examination, which should never be neglected, one may, in some cases, perceive the tumor.

Serious general symptoms accompany these various signs. The child's skin, which is at first pale, takes on an earthy tint, he cries plaintively and becomes restless. The pulse becomes very rapid, while the temperature goes below normal and the skin is covered by a clammy sweat.

The clinical evolution occupies two stages: one corresponding to the anatomical stage, in which the invaginated segment, as yet free from any lesion, produces an incomplete obstruction. The second corresponds to the strangulation and gangrene of the invaginated segment and complete intestinal obstruction. It is at this time that the symptomatology is typical, because there are those of intestinal occlusion with melæna, and an abdominal tumor to be felt by palpa-

tion. When left to itself the process goes on to gangrene of the involved segment, followed by a fatal peritonitis. The elimination of the invaginated segment is one manner of spontaneous recovery very infrequently met with, and which does not protect the patient from complications, as I shall presently show. Early diagnosis should be made, for upon this depends the prognosis. One must establish the presence of an occlusion. To do this the positive signs of intestinal occlusion must be used. These we have already considered. An important fact is to be mentioned and that is, when in presence of the clinical signs of the process one must not neglect to examine the hernial openings in order to eliminate a possible strangulated hernia.

When the diagnosis of occlusion has been made, the next thing to do is to discover its nature. In the case of invagination in infants a differential diagnosis must be made of all the various intestinal hemorrhages, because in invagination the essential symptom is melæna. But, should there be coexistence of bloody stools and symptoms of occlusion, the diagnosis is certain if one finds an abdominal tumor by palpation.

In children the diagnosis is an easier matter, because the majority of cases of occlusion during the first few years of life are due to invagination. There is a pathognomonic sign which imposes the diagnosis, namely, the exit from the anus of the invaginated segment, because in this case the invagination cannot possibly be mistaken for rectal prolapse or polypus, which do not give rise to symptoms of occlusion nor to the general physical condition arising in obstruction.

When the invagination takes place in the ascending colon the differential diagnosis with appendicitis may really be most difficult, but in invagination the tumor can be moved in the vertical direction, while in appendicitis the tumor is fixed.

At the present time medical treatment is no longer considered in acute intestinal invagination. Purgatives are to be absolutely discarded, for their use leads only to disaster. Intestinal irrigation is quite plausible theoretically, but in practice is to be rejected. Half a litre of liquid is quite enough to rupture the bowel in a three-month-old infant. Insufflation of gas, air, or carbonic acid is not to be considered, because it is, perhaps, only applicable in some few

well-determined cases, but, even then, one is never sure of having obtained a complete reduction of the invagination.

Surgical treatment consists in opening the abdomen, preferably at a point over the tumor, if this can be distinctly felt. When the case is dealt with early in the process one may try to reduce the invagination. This should be proceeded with with very great prudence—not by traction on the gut, but by expression. To accomplish this, circular pressure is made over the invagination, but with very great gentleness and not persisted in if the desired result is not quickly obtained.

The mortality considerably increases with the lapse of time between the first symptoms and the operation, but when it can be accomplished reduction of the invagination is the method of choice, for it is rapidly done and relatively easy. Some instances of recurrence have been recorded.

When reduction does not succeed, resection of the invagination with enterorrhaphy is imperative. Colostomy is out of the question, for the good reason that the invagination is not cured, and gangrene of the gut being, for this reason, inevitable, a fatal outcome shortly occurs.

It is hardly necessary for me to describe the technic, which is well known and can be found in all text-books on surgery, but it is necessary to note a few points relative to the results. According to Dewal, 30 per cent. of the cases are successful, but, no matter what method is employed, the prognosis depends directly upon the age of the invagination. I find the following table gives a fairly good idea of the operative results, although I esteem the mortality, when operation is done within twelve hours, is much too high :

Operation done before 12 hours have elapsed, mortality 14 per cent.
Operation done before 24 hours have elapsed, mortality 34 per cent.
Operation done before 36 hours have elapsed, mortality 36 per cent.
Operation done before the second day, 37 per cent.
Operation done before the third day, 54 per cent.
Operation done before the fourth day, 78 per cent.

My own experience teaches me that if the medical man will only turn the case over to the surgeon within the first ten or twelve hours from the time the symptoms first appear, and the surgeon, in turn, operates without waiting to see what may turn up, the mortality may

readily be reduced to 2 per cent. or even 1 per cent. In 1911, Rington reported a series of fourteen cases with fourteen successful operative results. These speak for themselves and fully bear out my statement.

V. *The Pathogenesis of Pulmonary Embolus Following the Radical Cure of Inguinal Hernia.*—This complication necessarily follows upon a thrombosis of the pelvic veins or those of the lower limb. For an embolus to form, a thrombosis is necessary; therefore, the study of the causes of thrombosis results in the demonstration of the mechanism of embolus, and of these infection unquestionably plays the most important part. The *Staphylococcus albus* is the cause of mild infective processes, and, even after careful sterilization, an infective focus may form around a suture or a ligature far more frequently than is generally admitted. The peritoneum, being in good condition and in possession of all its means of defence, easily rids itself of bacteria introduced in small numbers, but if any of the necessary conditions are lacking, a small local focus is the result, from which arises the possibility of a thrombosis. There is no operation whatever that can be ideally aseptic and give the operator complete security.

The hernia sac formed by the vaginoperitoneal canal is situated in the midst of the component parts of the cord, which adhere to it more or less, and an ulceration of the spermatic veins, followed by a thrombophlebitis, resulting from the dissection of the sac, is one cause to be seriously taken into consideration. The numerous large and frequently varicose spermatic veins are predisposed to infection and phlebitis. How many times does every surgeon encounter a tumefaction of the cord, lasting for some time, even when the operation of hernia has been conducted with the greatest aseptic care! This tumefaction is inherent to the consequences of manipulation of the cord, to traumatic lesions of the veins during the interference while breaking up the adhesions, etc.

Sex and age appear to have no part of any import in the matter under consideration, and if this postoperative complication is more common in the male, it is simply due to the fact that inguinal hernia is more common in man than in woman. Then, too, the radical cure of inguinal hernia in the female is much simpler, and, being more easy, there is less chance of wounding the vessels. In some cases I

am inclined to suspect that the omentum, particularly when very vascular and inflamed, may be the starting-point of the venous infection, especially when a portion of it has been resected.

In reality a lesion of a venule of the endothelium is all that is necessary, the endothelium playing a foremost part of defence in respect to the infective toxins, so that the resulting lesion, either at the point of ligature of the vessel or the tear of venules seated in the operative field, may very well result in a change in the leucocytes and a coagulation. It may be, too, that a change in the omental vessels can give rise to pulmonary emboli by the anastomoses existing between the portal system and the inferior vena cava. In a case of my own there is no doubt that the pulmonary embolus came from a phlebitis following ligature of a venous plexus.

In order to explain a femoral thrombus, a traumatic lesion of the epigastric vein on the corresponding side has been evoked. During their course both epigastric veins are united to each other by transversal or oblique anastomoses in sufficient number to form a plexus, and, in cases of inguinal hernia, these are in relation to the neck of the sac. This accounts for epigastric phlebitis with involvement of the femoral vein on the opposite side.

Why the left side is more frequently the seat of the process may, perhaps, be explained from the fact that the venous circulation is slower than on the right. On the left there are several reasons for this slowness, one being the sigmoid flexure filled with faeces, which compresses the left-iliac vein; then the arteries cross the veins and press on them, while the greater length of the route followed on the left side by the blood is also a reason.

Trauma during operation to a vein may be quite sufficient in itself to cause thrombosis without there being infection. Traumatism changes the endothelium of the veins, and this simple change, by liberating a few cells, causes them to become foreign bodies around which clots may form in the way that any form of foreign body is introduced into a blood-vessel. And all this occurs without the intervention of bacteria, which, of course, is the ordinary factor, and quite independent of a slowing down of the blood current or of blood changes, both of which causes I shall now dwell on; for, although unquestionably infection plays the principal part in the production of a thrombosis, in most cases there are certainly other factors which

favor it, such as blood changes producing coagulation and also a decrease in the intensity of the venous blood current. At the present time the tendency is to see only infection in all these cases and to deny all other causative factors. The thrombus arises only in a vein following upon a change in the endothelium of the vessel. In several cases I have found it a difficult matter to admit the occurrence of a primary infectious origin, as the wound in each case was microscopically and bacteriologically negative, repair having taken place without the slightest untoward symptom. I cannot understand why, theoretically at least, it is not perfectly possible in a vein suddenly occluded by compression, either temporarily with a hæmostat or permanently with a ligature, for the stagnant blood current to become less susceptible to rapid coagulation, and from the fact of the intravenous arrest of the circulation the immobility may facilitate the solidification of the fibrin. I see no reason whatever why this reasoning is not perfectly logical, although I am perfectly aware that it is fearfully old-fashioned, but, nevertheless, although I am not old, I have seen in my day many an antique theory revived and accepted, though disdained by many of my generation.

Returning now to modern work, it has been shown that coagulation is due to a ferment developed by the destruction of the elements of the blood; but the chemical change alone is not generally sufficient to produce coagulation. The wall of the vessel is supposed by some to prevent coagulation in the living on account of a catalytic action which destroys the ferment, so that it is the integrity of the vessel walls that prevents coagulation. Nutritive or traumatic changes favor coagulation, but an aseptic ligature without trauma leaves the blood perfectly liquid.

Vaquez has shown that a slowing down of the blood current favors thrombosis, but is in itself insufficient to produce it, and he explains thromboses in arteriosclerotic subjects and in old cardiacs by the weak cardiac impulse which results in a slow circulation. Any hindrance to the free circulation of the blood is a predisposing cause. Thrombosis, as demonstrated long since by Lancereaux, always forms in these portions of the vascular system where the blood has the greatest tendency to stasis,—that is to say, at the limit of action of the cardiac impulse.

Blood changes also enter into play, and among the patients re-

quiring operation many are anæmic, either on account of insufficient nourishment or overwork, others from some diathesis, such as cancer or some cachexia producing a dyscrasic state of the blood favorable to the formation of a thrombus.

The anæsthetic used has sometimes been incriminated. Chloroform produces changes in the hepatic cell which may even go as far as degeneration. Urobilin appears in the blood, and the hepatic cell, having become insufficient, no longer fulfils its antitoxic part, allowing the passage of toxic substances which accumulate in the blood.

The blood-cells themselves become altered. Studying the capillaries of the frog poisoned by chloroform, Witte saw the globules become spherical, present club-shaped prolongations, and become arrested at certain points, forming pulmonary emboli. However, the part played by chloroform is, I believe, of only relative importance in practice.

As causes favoring thrombosis some writers, particularly the Teutons, have supposed that a too long rest in bed was a factor. Others have mentioned abdominal distention following laparotomy and chilling of the peritoneal cavity during operation. Hochenegg accuses a latent infection from the intestine,—a plausible hypothesis after the radical operation for hernia. From personal experience I am inclined to believe that obesity may have a predisposing influence on the formation of embolus.

When the patient has no hereditary antecedent, no intercurrent affection, nor the slightest trace of infection, can we assume that he has an aseptic traumatic phlebitis? I think in answer we can say that when the trauma involves a varicose vein coagulation is more considerable and persistent and may end in obliteration, just as occurs in an infectious phlebitis. This asepsis of postoperative phlebitis includes only those cases where the venous trunk has been directly traumatized, and no phlebitis of the spermatic veins following a radical operation for hernia, whose sac is peeled off with difficulty, resulting in confusion of the veins of the cord, occasionally presents such satisfactory conditions of clinical asepsis that, in spite of the absence of a convincing direct bacteriologic examination, the hypothesis of an infectious phlebitis seems unlikely.

Of course, in most cases the thrombosis is a manifestation of a general organic infection or an infection starting from the area of

the hernia. Infection also must be incriminated to explain those thromboses arising some distance from the seat of operation ten to twenty days later. The apparition of the thrombus is favored by lesions of the vessels, a slowing down of the venous circulation, changes in the blood causing more rapid coagulation, and the presence of varicose veins in the lower limbs.

Now, the small intestine, the usual contents of a hernia, is a very vascular structure; its veins, by their anastomoses, form the great mesenteric vein, which is one of the branches of the portal vein. By the intermediary of the peritoneum the small intestine is in contact with numerous parietal and visceral veins of the pelvis.

The primal elements of the coagulum are composed by altered leucocytes, whose action is completed by that of the hæmatoblasts, which become the centre of fibrinous reticuli. The clot thus formed at the level of a vascular spur or a venous valvule is propagated in the direction of the blood current. The blood stagnating in front of this obstacle coagulates in its turn, giving rise to a secondary clot, which extends to the point where the vein opens into a main branch. It extends even beyond this opening and penetrates into the lumen of the vessel, into which it projects like the head of a nail. This head, incessantly struck by the blood current, becomes fragmented, then detached, and is thrown into the circulation, soon to give rise to an embolus. In other instances the adhesion of a primary or secondary clot is not sufficiently strong, and often it is at the time the patient is to leave his bed that the clot becomes detached. It is carried by the blood current, passes into the vena cava, where it freely circulates, reaches the right auricle, whence it is thrown into the pulmonary artery. The obstructing clot is all the more likely to break its adhesions if the patient be debilitated or if he presents some organic taint.

When once a pulmonary embolus has taken place, three cases can present themselves, according to the calibre of the artery occluded. If the artery is small, we have a capillary embolus; if of medium calibre, a lobular embolus; and, lastly, if a large embolus becomes arrested in the main trunk or in one of its principal branches, a lobar embolus results.

In capillary embolism, on account of the arrangement of the pulmonary circulation in which the arteries are terminal, an anæmia

of the area irrigated by the occluded vessel first takes place, after which an infarction forms. If the vessel primarily involved recovers its permeability, the area of the infarct will be restituted *ad integrum*; otherwise fibrous or calcareous transformation arises. If, on the other hand, the embolus was septic, a focus of gangrenous or suppurating pneumonia results.

When the embolus is of medium size, a lobular or lobar embolism occurs, according to circumstances. If death does not take place, pulmonary congestion and œdema ensue, sometimes even an infarct of the entire lobe when progressive asphyxia with repeated hæmoptysis is observed. When the embolus is large enough to occlude the main trunk of the pulmonary artery sudden death takes place or, at least, is not long delayed.

VI. *Gunshot and Bayonet Wounds of the Stomach.*—The unfortunate war in Europe suggests the following brief remarks, which are compiled from my lecture notes on the "Surgery of War."

A bayonet wound is practically similar in all respects to any type of stab wound, but the lesions produced by the Lebel bayonet present some special aspects which should be examined. The Lebel bayonet has four sharp, longitudinal projections, separated by four corresponding grooves, and its effects have been studied by Sieur. He found the wounds resulting in the stomach and intestine were rounded, with irregular and slightly contused borders. In the experiments which Sieur undertook on dogs he found that after the bayonet had been withdrawn the borders of the wound came back in contact with each other, resulting in a complete occlusion of the perforation, from which it was difficult to force out the gastric contents. On the other hand, when the arm remained in place, the grooves formed true gutters along which the gastric contents escaped and accumulated in the peritoneal cavity. Sieur is of the opinion that this bayonet acts by retracting the tissues, rather than by their section or laceration, and this applies to the muscular fibres in particular. A soldier who was wounded in the epigastrium and who died from a wound of the aorta showed at autopsy that, although the stomach was full of food and completely transpierced, no gastric contents were found in the abdominal cavity. A young girl who was wounded in the epigastric region by a Lebel bayonet presented distinct symptoms of gastric perforation, but recovered without operation.

Referring now to the most important part of the subject, that of gunshot wounds, it may be said that to-day the armies of all civilized nations employ a pointed projectile of small calibre, animated by a very great penetrating force, but, as might be expected, judging from recent events, we already have reports from the Belgian surgeons of the removal of the dum-dum bullets in use by the Germans. The modern projectile is elongated in shape and of an average calibre of seven millimetres; its length is equivalent to about four times that of its calibre, and it weighs about fifteen grammes. The nucleus is composed of an amalgam of lead and antimony, which forms a very hard mass, and is, at all events, covered at the apex and usually also in its entire surface, the base excepted, with an envelope of hard metal. Of the new German S bullet, the new French D bullet, and other types now being studied in Switzerland and elsewhere, we have, unfortunately, had an overabundant demonstration of their respective value.

The lesions differ according to the distance at which the arm is fired. Beyond 300 metres, these projectiles produce simple perforations which are small and circular, the bullet entering the tissues like a gimlet, spreading them apart, with the result that the borders of the wound may close together, producing an almost complete occlusion. The opening of the exit of the projectile is generally somewhat larger than that of entrance. When the firing distance is less than 300 metres the lesions vary according to the state of plenitude of the stomach. When the organ is empty the wounds present the same characters as those just enumerated, and the resulting disturbances will be slight, but the same cannot be said when the stomach is distended with food, and the result is a genuine bursting of the viscus. Such lesions have been made experimentally by Delorme and reported in his work on the "Surgery of War." He states that under these circumstances, besides the entrance perforation, which has the diameter of the projectile, with the exit perforation considerably larger, the viscus presents large lacerations and extensive rents.

Gunshot wounds of the stomach are very frequently accompanied by wounds of the neighboring viscera. When the shot is fired at a moderate distance the projectile generally transpierces the subject, passing through the pleura, lung, liver, spleen, pancreas, kidney, or

even the pericardium and heart. The minimum of damage is met with when the projectile enters the area of Labbé's triangle, an area in which the stomach is in direct relation with the anterior abdominal parietes, but even here the organs situated behind the stomach (kidney, pancreas) will probably be involved. In other instances the track of the projectile in the tissues is much longer when the bullet follows the exit of the body. This is met with frequently in soldiers who were in the recumbent position at the time they were shot, and under the circumstances the lesions are multiple and varied. In one case the point of entrance was in the anal region, while the point of exit was found in the left sixth intercostal space in the mammillary line. The bullet lacerated the hypogastric vein, perforated the small intestine several times, likewise the colon and mesentery, and also went through the stomach.

Such cases are of no clinical interest, however, because death takes place before any aid can be offered, and, although such lesions are frequent on the battle-field, there are, fortunately, instances in which the stomach alone is involved, or at least represents the principal lesion. It is just these cases that we may possibly consider as being justifiable to operate on.

Let me now revert for a moment to what I may term the *area of gastric vulnerability* and which corresponds to the projection of the stomach on the abdominal wall. Over the *anterior* abdominal wall this area has an oval shape, with its axis slightly inclined from left to right and from above downwards, whose greater extremity occupies the left hypochondrium, while the lesser is situated to the right of the middle line corresponding to the pylorus. Its upper limit is represented by a curved line, with its concavity parallel to that of the diaphragm, whose uppermost point is at the level of the left fifth rib in the mammary line. This point undergoes slight oscillations with the respiratory movement.

The lower limits vary. When the gastric cavity is empty they correspond to a transversed line passing at the point of union of the ninth and tenth rib on each side. When the stomach is distended, it becomes displaced downwards, and, since opinions differ as to this point, I merely say that the most declivous point of the full stomach will be found in the neighborhood of the umbilicus.

The left lateral limit in the state of complete distention becomes

confounded with the limits of the hypochondrium. Usually it attains a vertical line passing slightly to the outer aspect of the nipple. The right extremity corresponds to the pylorus, which is also subject to variations, but which, in its mean situation, is found behind the eighth rib, this point corresponding to the external border of the rectus.

Over the *posterior abdominal wall* the projection of the stomach effects a shape similar to the preceding. The culminating point of its upper curved limit is at the middle of the eighth rib in the left scapular line. In the middle line its upper limit, corresponding to the lesser curvature, obliquely crosses the spine from left to right and from above downwards, extending from the left side of the tenth dorsal to the right side of the first lumbar vertebra. When the stomach is distended the lower limit reaches about to the spinous apophysis of the second lumbar vertebra.

Let it not be understood that a wound whose orifice of penetration is located outside the limits of the area here given may not involve the stomach. With firearms this can very well happen, but in this case involvement of the stomach is rather the exception.

Gunshot wounds are the most frequent of any in battle, lesions from the bayonet the exception. Usually the damage done by the projectile within the abdomen is so extensive that death results at once. Logically, it may well be argued that a laparotomy is indicated to control the dangers of intra-abdominal hemorrhage, and, above all, the effusion of the gastric and intestinal contents. This is what the majority of surgeons thought who were called into action in the South African war, and everything had been prepared for the treatment of abdominal wounds by immediate laparotomy. But the results of this practice quickly showed that the mortality of the operated cases was greater than that of those patients treated by temporization, and the conclusion in all the amount of matter written on the subject is that a great number of those thus wounded die before they are removed from the field; that among those removed a number die from peritonitis, but quite a large proportion recover without operation, and that almost all who submitted to laparotomy died. Consequently, at the present time opinion is unanimous that abstention is proper, and this is undoubtedly the correct view in the vast majority of cases, since the time required in carrying out these operations is

simply loss of time, which could be far more fruitfully employed in the treatment of other injuries.

The results were quite the same in the Russo-Japanese war, and it is sufficient to read the article by the Russian military surgeon Wreden, published in *The Military Surgeon*, March, 1907, in order to become convinced. In his paper on abdominal wounds in the same war, published in the 84th volume of Langenbeck's *Archiv.*, Bornhaupt gives statistics of 182 cases treated. All the cases were brought in late to this surgeon, and he obtained a cure in 78 per cent. of those treated by conservative surgery, while 50 per cent. of the operated cases died, but it must be said that the majority of these presented peritonitis at the time of operation.

Peritonitis is the only late indication for operating, and in these cases the operative act should be reduced to the minimum: simple incision, to let out the pus and drain the peritoneal cavity, without searching for the gastric lesion, which, unlike wounds of the intestine, have a much more favorable evolution. However, the existence of lesions of the neighboring viscera may create special indications, such as hernia of the intestine or omentum, and, above all, intra-abdominal hemorrhage. What has been said of gunshot injuries to the stomach applies quite as well to lesions from the bayonet, whose resulting wounds generally have a favorable evolution.

The conservative treatment consists in absolute rest, and, if possible, the subject should not be mobilized. This latter is the first condition of conservative treatment. Morphine and opium are to be administered and an absolute diet maintained for the first few days, which should be continued just so long as there is any doubt about cicatrization of the gastric perforation. Usually, feeding by mouth can be prudently commenced by the fourth day, but it may have to be postponed for a week or so. During this time rectal feeding is exclusively employed, along with the subcutaneous administration of physiologic salt solution.

As I have already said, there are cases which will die from internal hemorrhage if not immediately operated on, and this is the only indication for surgical interference in abdominal wounds when the patient reaches the field-hospital.

INTRANASAL FRONTAL SINUS OPERATIONS: CONSERVATIVE SURGERY

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DURING the past fifteen years there has been a growing tendency to abandon external operations upon the frontal sinus, and to substitute therefor various methods of intranasal operating. Doubtless many cases previously operated by the external route could now be successfully operated by the intranasal route. Notwithstanding this there is still a field for the external operation. Not all cases of frontal sinus suppuration can be cured by the intranasal route, especially those cases in which there are partial, though almost complete, septa, and those in which there are bone necrosis and extensive granulation tissue. In one such case the author failed to get results after an intranasal operation, and upon doing the Killian operation found the left sinus entirely denuded of mucous membrane and periosteum, the bone being quite porous and chalky in texture. After draining the sinus by the Killian operation the suppuration entirely ceased and the accompanying asthma was cured. The asthma was so severe that for weeks at a time the patient was compelled to sleep sitting with the head resting upon a table.

While there will be cases requiring the external operation, we must admit that most of them may be successfully handled by the intranasal route. This is of great importance to the patient, as it avoids the possibility of disfigurement which sometimes attends the external operation, especially in those cases in which the sinus is deep and broad. The intranasal operations are also less severe and are not attended by as great shock, though, unless performed with great skill and the proper technic, they may be more dangerous than the external operation.

We shall not attempt to discuss the comparative merits of the various intranasal operations, but will confine our remarks to a few of the procedures, and will not even then enter into a discussion of the technic except in so far as may be necessary to make the point

under discussion clear. It is assumed that nonsurgical measures have been tried and found ineffectual before surgical procedure is determined upon.

The various operations may be classed as (a) burr or drill operations, (b) rasp or file operations, and (c) curette operations.

Of the burr and drill operations mention may be made of the Ingalls, Halle, and Watson Williams operations, though some of these are modified by other technical procedures, as the use of biting forceps and the curette.

Of the raspatory operations mention may be made of the Good, Sullivan, Vacher, and Segura operations.

Of the curette operations my remarks will be confined to Mosher's operation, which I have performed about fifty times.

Instead of discussing the desirability of these various operations, I shall confine my remarks to some general principles, which, being based upon a rather large experience in intranasal surgery, I hope will help to clear the atmosphere in reference to the intranasal drainage of the frontal and anterior ethmoidal sinuses.

ANATOMICAL CONSIDERATIONS

To understand the drainage of the frontal and anterior ethmoidal sinuses, the anatomical topography of these regions should be borne in mind.

(a) Some of the anterior ethmoidal cells drain directly into the frontonasal duct, which drains the frontal sinus. As a result of this relationship to the frontonasal duct or canal the involvement of the frontal sinus is nearly always accompanied by an involvement of some of the anterior ethmoidal cells. Hence, in considering the drainage of the frontal sinus, consideration must also be given to the drainage of the anterior ethmoidal cells. The one cannot be accomplished without the other. The frontonasal canal opens into the floor of the frontal sinus near its median wall, and extends downward and backward to a point below the attachment of the middle turbinal body, and ends in a semilunar groove or open gutter, known as the infundibulum (Fig. 1, I). The frontonasal canal and the infundibulum may be considered as one continuous canal, the upper portion of which is a closed, irregular, tubular canal, while the lower or infundibular portion is an open or groove-like gutter. Some of the

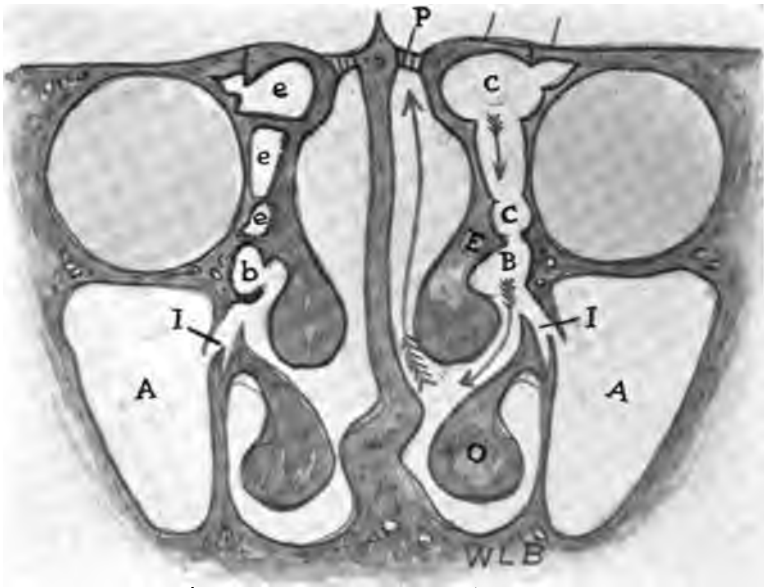
more important anterior ethmoidal cells open into the upper or closed canal, especially on its orbital aspect, though some open into its anterior and its posterior aspects (Fig. 5). Some ethmoidal cells also open into the infundibulum or open portion of the canal, while the bulla ethmoidalis and the concha ethmoidalis open directly into the middle meatus above the infundibulum (Fig. 3). In empyema of the frontal sinus, the ethmoidal cells, draining directly into the closed upper portion of the canal, are most often affected, because of their intimate connection with the portion of the canal concerned with the drainage of the frontal sinus. The bulla ethmoidalis and concha ethmoidalis are not so often involved because of their direct drainage into the middle meatus. In some cases the crista nasalis projects backward and interferes with the opening of the floor of the frontal sinus, unless it is also removed. As this bone is dense it can only be removed with a burr or a strong sliding bone-forceps (Figs. 4 and 5, *F'*).

It is obvious, from the foregoing data, that in order effectually to drain the diseased frontal sinus it is necessary to do it *via* the frontonasal canal (closed portion of the drainage conduit), which necessitates converting the canal and the anterior ethmoidal cells draining into it into one enlarged space or canal; that is, it necessitates the destruction or exenteration of the anterior cells surrounding the closed canal, and the reduction of the dense, bony crista nasalis. Through this enlarged outlet the frontal sinus may usually be adequately drained and the empyema cured.

(b) The second anatomical feature to be considered is the middle turbinate body, the anterior end of which covers the lower portion of the closed canal and entirely overhangs the infundibulum (open portion of the canal), and may become an obstruction to the free flow of secretion from the frontal and anterior ethmoidal cells. This is especially true when the anterior end of the middle turbinate is enlarged either from hyperplasia or bullous enlargement, the so-called concha turbinalis (Fig. 3, *ch*). It may also become an obstructive factor where a high deviation of the septum crowds it toward the orbit. Hence the middle turbinal must be considered in the treatment of fronto-ethmoidal disease.

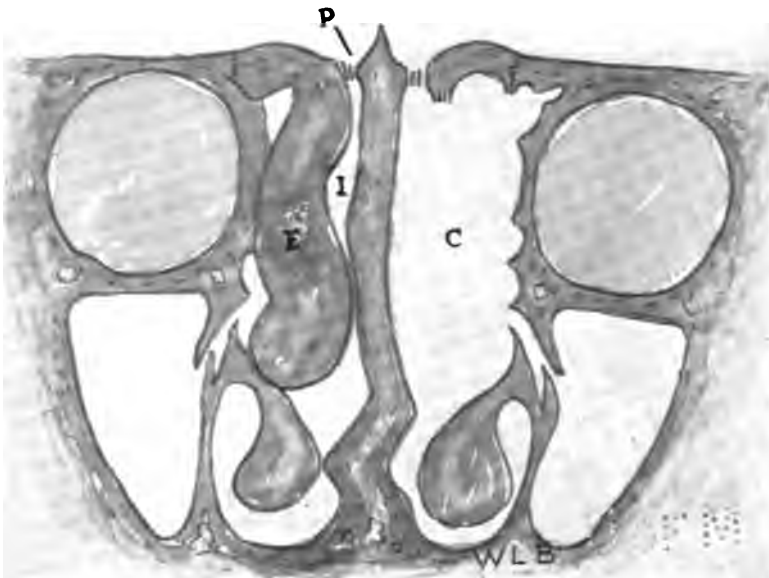
(c) The bulla ethmoidalis is the third anatomical factor to be considered in the drainage of the frontal sinus. The bulla is located

FIG. 1.



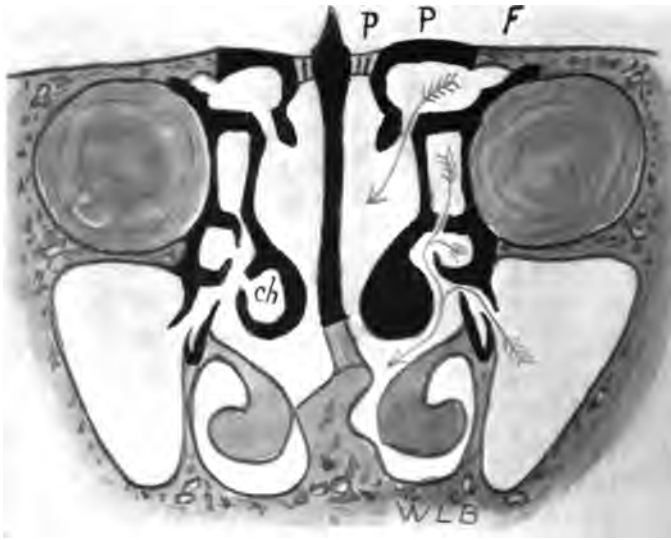
Diagrammatic. *A, A*, right and left antri; *O*, inferior turbinate; *I, I*, infundibuli; *B, b*, left and right bulla ethmoidales; *E*, ethmoid plate; *C, C*, exenterated ethmoid cells; *e, e, e*, ethmoid cells; *P*, cribriform plate.

FIG. 2.



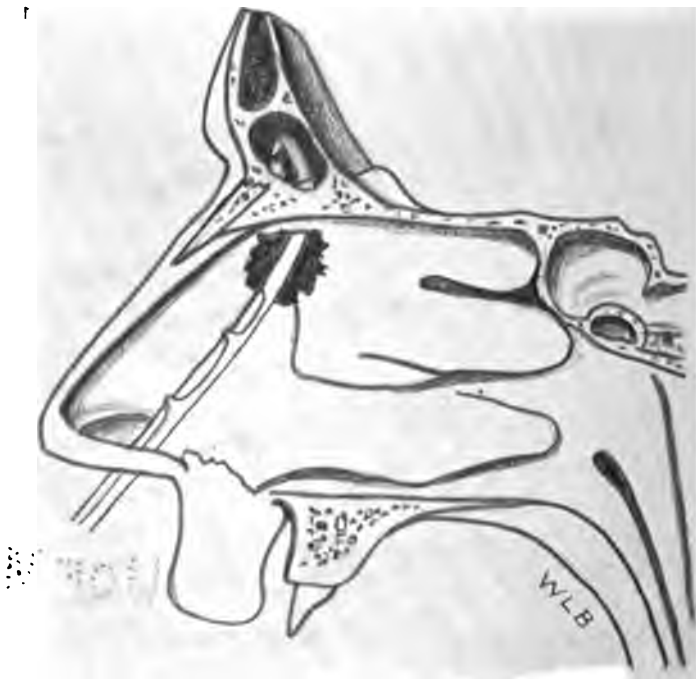
Diagrammatic. *C*, total exenteration of ethmoid cells and ethmoid plate, leaving large drainage space; *E*, swollen ethmoid plate left *in situ* after exenterating the ethmoid cells; *I*, small drainage area due to swollen ethmoid plate; *P*, olfactory perforations in the cribriform plate.

FIG. 3.



Diagrammatic. *P, P*, cribriform plate; *F*, frontal plate partially covering the ethmoid cells. Upper arrow shows drainage route from the posterior ethmoid cells into the superior meatus. Lower three-tailed arrow shows drainage routes from the antrum and anterior ethmoid cells. *ch*, bulla conchalis, or anterior ethmoid cell in the middle turbinate.

FIG. 4.



Showing cutting bone forceps removing the crista nasalis in front of the osteum frontalis, the anterior cells having been removed by curettage according to Mosher's technic.

under the attachment of the anterior half of the middle turbinal, above the hiatus semilunaris, and may impinge upon the hiatus and obstruct the flow of secretion from it into the free space of the middle meatus of the nose (Fig. 1, *b*). In such a case it may only be necessary to curette and thus destroy the bulla ethmoidalis to establish free drainage of the frontal and the remaining anterior ethmoidal cells (Fig. 1, *B*).

(*d*) The fourth anatomical feature to be borne in mind is the extreme anterior attachment of the middle turbinated body, as it is the landmark by which the closed frontonasal canal and the anterior ethmoidal cells draining into it are orientated; that is, they are located above this point, and are covered by an extremely thin wall of bone, which may be easily broken into with a suitable curette, as has been shown by Mosher. Occasionally the more anterior cells are covered by dense bone from the agger nasi anteriorly (Fig. 5, *A*), in which event the curettage must be made a little posteriorly. Mosher's operation is based chiefly upon the knowledge of these simple anatomical facts.

(*e*) The fifth anatomical factor to be held in mind is the width of the space between the septum and the orbital or outer plate of the ethmoid cells. First study the free air-spaces from the septum to the orbital plate with the middle turbinate in position (Fig. 1); and, second, study it with the middle turbinate and cells removed (Fig. 2, *C*). Note the greatly-increased space with the turbinate removed. Then study it with the cells removed and the middle turbinate (Fig. 1, *E*) in position, and note the relatively narrow spaces for drainage. From this study it becomes obvious that in some cases it will be necessary to remove the anterior half or third of the middle turbinated body to establish free flow of secretion from the frontal and anterior ethmoidal cells, whereas in others it may not be necessary to do so. The aim should always be to remove as little tissue as will establish adequate drainage of the involved sinuses.

(*f*) The sixth anatomical factor to be borne in mind is the cribriform plate of the ethmoid, as injury to it might result in meningitis and death. The anterior end of the cribriform plate is directly above the anterior attachment of the middle turbinate body, sometimes a little more anteriorly. It is also medianward toward the septum. If these facts are borne in mind during the curettage of the anterior

ethmoid cells and the removal of the ethmoid plate it need not be injured.

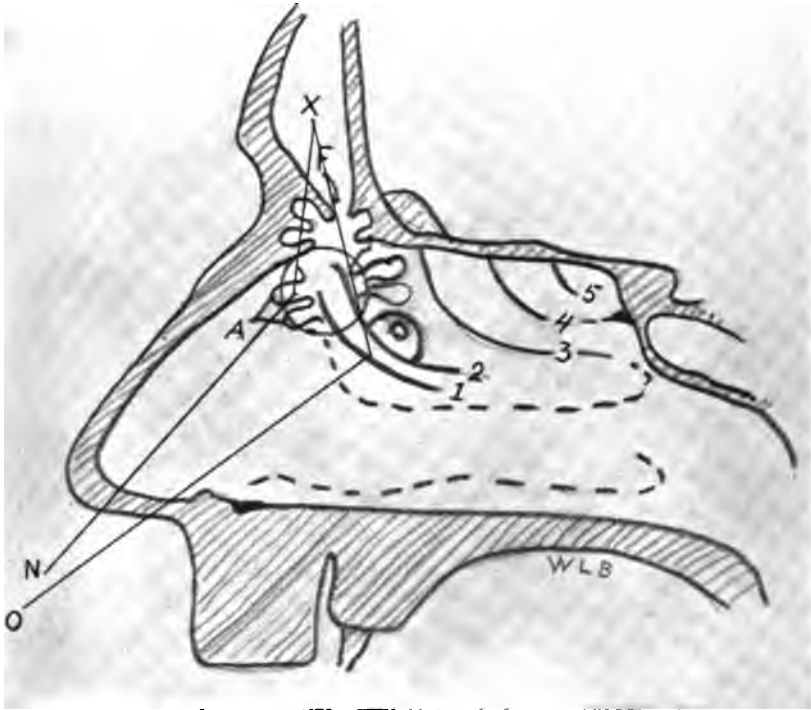
(g) The seventh anatomical factor bearing upon intranasal operations upon the fronto-ethmoid sinuses is the relation of the bony plates from which the turbinated bodies and the cells develop. By reference to Fig. 5 it will be shown that there are four and sometimes five plates, the first being the uncinate plate from which the uncinate process (median wall of the infundibulum) is formed. Sometimes cells, known as infundibular cells, also spring from this plate. The second plate is the one from which the bulla ethmoidalis springs. The third is the middle turbinal plate, and the resorption of the bony tissue between it and the bullous plate gives rise to most of the anterior ethmoidal cells. The fourth is the superior plate from which the superior or fourth turbinate springs. The posterior ethmoid cells arise from the resorption of the bony tissue between this and the middle turbinate plate and drain into the superior meatus of the nose. The fifth plate (rare) forms the foundation of the supreme turbinate.

PRACTICAL DEDUCTIONS

Having given due consideration to some of the more important anatomical data bearing upon the intranasal surgery of the frontal sinus, we are prepared to discuss their bearing upon the operative technic. Two factors are constantly striven for; namely, (1) the safety of the patient, and (2) adequate drainage. The safety of the patient should always take precedence when the two factors conflict. To this end the operative technic should be such that it has the least possible chance of injuring the cribriform plate, and at the same time establishes adequate drainage of the frontal and ethmoidal sinuses. To aid in getting a proper perspective on these cases we will make the following practical deductions, which, reviewed in the reverse, orientate the various indications for treatment:

As shown in paragraph (a) under "Anatomical Considerations," the most natural and accessible route for the artificial drainage of the frontal sinus is *via* the anterior ethmoidal cells, which open into the closed portion of the frontonasal canal. The canal lies at a point almost directly above the anterior attachment of the middle turbinate body on the outer wall of the nasal cavity, and the ethmoidal cells in

FIG. 5.



Diagrammatic. 1, first or uncinat plate; 2, second or bulla ethmoidalis plate; 3, middle turbinate plate; 4, superior turbinate plate; 5, supreme turbinate plate (rare); *P*, process frontalis; *O, X*, line of catheterization of frontal sinus before intranasal operation; *Z, X*, line of catheterizations of frontal sinus after intranasal operation.

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Wheeler

question lie external, anterior and posterior, to it (Fig. 5). There are no cells medianward to the canal; that is, the curette when applied to this region with slight force penetrates directly into the fronto-nasal canal, or into a cell either directly anterior or posterior to it. Having entered into these air-spaces, their limitations may be readily outlined with a curved silver probe, and curettage carried out without undue trauma to the surrounding tissues. Having removed the median wall of this area (see circle, Fig. 5, and black area, Fig. 4), and the septa dividing the cells, the curettement may be carried forward, where the enveloping bone and septa are more dense, without danger of injuring the cribriform plate. The bone enveloping the cells anterior to the canal, being of greater density (*agger nasi*), requires vigorous instrumentation to break it down (Fig. 5, A). Good's rasp-files (or Sullivan's) are sometimes employed for this purpose. I have had some experience with Good's rasps and have found them to be efficient for this purpose. My objection to the rasp is that it must be used with a to-and-fro or sawing motion, the upward stroke of which is liable to injure the cranial plate lateral to the cribriform plate and posterior wall of the frontal sinus. Fortunately I have had no untoward results following its use. However, as the safety of the patient is the first consideration, I have ceased using the rasp and have substituted therefor the curette, which has proved most satisfactory.

I do not employ either the Ingalls pilot trephine or Halle's burrs. Of the two, however, I regard Ingalls's as much safer, though perhaps not as efficient as Halle's.

The paramount object of these or other procedures is to establish good drainage of the frontal sinus with the least possible danger to the patient, either as to nasal function or life. It has been a matter of surprise to me to learn how simple and gentle Mosher's procedure is, and how easily one may introduce a large cotton wound probe into the frontal sinus at its close, even while the middle turbinate is still in position. And, what is of still greater importance, the results have been uniformly good.

Is it necessary to remove a portion of the middle turbinate to establish adequate drainage of the frontal sinus? This question has given rise to considerable difference of opinion. Some authorities have questioned it upon the ground that its removal exposes the

meninges to danger of infection *via* the cribriform plate. They base the opinion upon post-mortem findings in which meningitis followed the removal of the ethmoid plate. The infection was shown to have traversed the openings in the cribriform plate. They reason that if the middle and superior turbinals, the so-called ethmoid plate, have been left *in situ*, they would have formed a barrier to the invasion of the pathogenic bacteria to the cranial cavity. Let us study the factors in the case and see how they bear upon the question.

Referring to Fig. 1, *e, e, e*, we see the ethmoid cells in place, also the bulla ethmoidalis (*b*). On the opposite half of the drawing the ethmoid cells and bulla are shown exenterated (*B, C*), with the middle and superior turbinals (ethmoid plate, *E*) unmolested. It has been left in position, according to this theory, to protect the cribriform plate from injury during the operation, and from subsequent infection. The idea is that in order for infective microorganisms from the wound to reach the cribriform plate they must traverse the distance around the ethmoid plate, which undoubtedly forms a physical barrier to infection, and if that were the only factor to take into consideration it would be a good idea to leave it in each case operated. Unfortunately there is another factor, often of the greatest importance, to be considered; namely, the establishment of good drainage of the operated area immediately following the operation. If this should not occur, the mucosa of the area may become enormously swollen and completely block the drainage, as shown in Fig. 2, *E, I*. Not only may the mucosa of the operated area become swollen, but that of the upper portion of the septum and of the median wall of the ethmoidal plate may also become swollen, thus blocking the area we are trying to protect. In such an event, the danger of meningitis becomes imminent. On the other hand, however, the removal of the ethmoidal plate may result in direct injury to the cribriform plate and cause meningitis. In any event we are between Scylla and Charybdis. If we steer the surgical bark in one direction, we may be wrecked upon the rocks of Scylla, and if we steer it in the other, we may be wrecked upon the bleak shores of Charybdis. The truth of the matter is that meningitis rarely occurs after either method of procedure. When it does occur, however, it is a sad eventuality. The thing to do is to study each case as it presents itself, and determine, as nearly as can be done by ocular inspection

and probing, the amount of space available for drainage with the ethmoidal plate *in situ*, and, if it seems ample, do not remove it. If it is found that the drainage space is small the anterior half of the ethmoidal plate may be removed to provide greater space. After its removal extreme care should be exercised to confine the use of the curette or other instrument to the orbital aspect of the cranial plate; that is, the instrument should not be used alongside the septum, the location of the openings in the cribriform plate.

The argument to be put forward for the removal of the ethmoid plate is that ample drainage is always provided for, as is shown in Fig. 2, *C*. Instead of two narrow spaces with four mucous membrane surfaces to become swollen, there is a space treble in diameter and with only two mucous membranes to become swollen. As a consequence the combined exenteration of the anterior ethmoidal cells and the removal of the ethmoidal plate are rarely followed by excessive swelling and blocking of the drainage. This opinion is not based upon theoretical grounds alone, but is based upon twenty years' experience. Both methods have been used by the author and much less trouble has attended those cases in which the ethmoidal plate was removed.

After trying various methods of draining the frontal sinus through the nose, I am convinced that Dr. Mosher's procedure is, on the whole, the simplest, most direct, and by far the safest and, at the same time, most effective yet devised.

THE APPLICATION OF SURGICAL PRINCIPLES TO OPERATIONS ON THE NOSE AND THROAT

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It is only within the past quarter of a century that the scientific side of rhinology and laryngology has advanced to the stage where it can be considered one of the more important specialties. This has been made possible by the numerous inventions which have given the workers in this field the opportunity to see into almost every nook and cranny of the cranial cavity.

Originally examinations of the nose and throat were made by direct sunlight. Nasal specula of wood were used until the nineteenth century. Examination of the throat required no special instrument. Then came the epoch-making discovery of Garcia—that the vocal cords could readily be seen through a mirror held up against the soft palate.¹ Later, with the advent of gas and electricity, it was found that indirect examinations from light reflected from a head-mirror were more reliable. With the invention of the metal speculum, the tongue depressor, the laryngoscope, rhinoscope, and head-mirror, it was a comparatively simple matter for one to train himself to a superior knowledge of the anatomy and pathology of these regions. Since then, especially within the past decade, diagnostic instruments of precision have become very numerous. The trans-illuminator and the X-ray have brought the sinuses into view; the nasopharyngoscope directly inspects the nasopharynx; the author's pharyngoscope makes the examination of the nasopharynx and larynx a very simple procedure; the laryngoscope and bronchoscope have revolutionized the work upon the larynx and bronchi.

¹ Czermak, in 1858, made use of lamplight and advised the employment of a "large, perforated concave mirror for reflecting either the sun or artificial light." Subsequently he very correctly asserted that but for this invention of the reflecting mirror laryngoscopy would have been "a dead-born child."

In the early years of this specialty very few of the men who were interested in it thought very seriously of it from the surgical point of view. Surgery itself was in its infancy. It was therefore but natural that laryngology should be looked upon as a medical, not a surgical, specialty. However, these men soon found that certain diseased conditions could be cured only by surgical intervention. Where could the surgeon be found who was sufficiently trained in the use of the reflecting mirror, the nasal speculum, and the laryngoscope? He couldn't be found, the result being that these early pioneers had to do the surgical work themselves. In the beginning this work was very crude, and the instruments used twenty years ago are now only useful in a medical museum. The writer has in his possession an ear speculum five inches long—suitable for examining an elephant's ear. He has also various designs of nasal specula and eustachian catheters that couldn't possibly be used on the delicate nose which comes to his office to-day. One must remember that these instruments were used before such anæsthetics and shrinking agents as cocaine and adrenalin were known.

The self-trained laryngological surgeon of thirty and forty years ago paved the way for the establishment of this specialty on a surgical basis. At first he worked crudely, as stated before, with poorly-devised and poorly-made instruments. But he worked out certain special surgical principles, many of which are still in use. Some of these men are still living; many of them have advanced with the times and are doing excellent work—discarding old favorite methods and following in the footsteps of their younger brethren.

It was but natural, as young, ambitious men came into this field, that they should recognize that laryngology to-day meant surgical, not medical, laryngology. Many men who have been thoroughly trained in surgery began to specialize in this new field. Frequently they worked with the older specialist, learning everything possible from him about the diagnosis of nose and throat conditions and then attempting to eradicate these diseased processes by methods more suited to the times. He often wished to bring his general surgical technic into play; he frequently desired to broaden the field of his work.

As a result of attracting these surgically trained men, laryngology has reached the dignity of a well-defined surgical specialty which

includes in its domain not only intranasal and intra-oral operations with which the older specialist was content, but the major surgical operations on the nasal sinuses, the delicate operations in the triangles of the neck, operations on the thyroid gland, intracranial operations, operations on the hypophysis cerebri, and, last but not least, operations for pathologic conditions of the larynx and bronchi.

In view of the fact that laryngology has advanced to this stage of perfection, the writer takes upon himself the task of setting before you the newer operations on the nose and throat which evidence in themselves that true surgical principles are being applied and that very few of the older, antiquated methods are still in vogue.

PLASTIC SURGERY

The reconstruction of featural deformities is attracting a great deal of attention. Formerly a great deal of this work was performed by "beauty specialists," many of whom knew little about surgery. Just so long as the competent, ethical surgeon kept out of this field, just for that length of time would the "faker" continue to ply a lucrative trade. So many people suffered from the bad practices of these vultures that it was necessary for the nasal surgeon to step into the field.

In doing plastic surgery of the face the surgeon must employ his creative genius, as no set rules can be laid down for this work. Here true surgical principles must be applied, or else the operator is sure to meet with disaster. One must consider every minute detail—from the maintenance of an aseptic field to the remodelling of foreign tissue to fit a new part. Dr. John O. Roe, of Rochester, N. Y., was one of the pioneers in this field, but within recent years many of the younger operators have done excellent work, among them Dr. W. W. Carter, of New York, and Dr. Lee Cohen, of Baltimore.

The surgical treatment of rhinophyma or "bulbous nose" has been exceedingly difficult. But this condition can be much improved and sometimes cured by proper surgery. One must realize that in true rhinophyma the pathologic process reaches into the deeper layers of the skin and that every particle of diseased tissue must be eradicated if one desires to get a successful result. Fig. 1 illustrates a patient with true rhinophyma who was operated upon at the City Hospital within the past year.

The operation was as follows: After the patient was placed under general anæsthesia, the nose was thoroughly cleaned with tincture of green soap and iodine. The surrounding parts were covered with sterile towels. The growth was removed, well beyond the diseased parts, with scalpel and scissors, down to the cartilaginous framework of the nose. Considerable bleeding was encountered, which had to be stopped before proper skin-grafts were applied. This was best accomplished by applying compresses of very hot saline solution. The arm was prepared beforehand for skin-grafting. After the dissection, small grafts, including all the layers of the skin, were removed and applied carefully to the denuded part. These were covered with sterile rubber tissue, over which was placed a piece of plain gauze held down by adhesive plaster.

A few days after the operation the gauze and rubber tissue were removed. The operated area was covered with dried-up particles of "graft" which were in a state of decomposition. A little boric acid dusting powder was applied and the part again covered with gauze. In the course of a week the grafts healed in place and the patient went about without any protective covering to his wound. In this instance the open treatment was very successful. Without a knowledge of general surgical technic an operation of this kind would have met with failure. Here the rhinologist had to "skin-graft," excise an external tumor, and understand thoroughly those surgical principles which would be of most importance.

The nasal surgeon who indulges in plastic work must be able to operate upon other parts of the body, particularly if he wishes to use bone transplants. The most successful work along this line has been performed by Carter, who has transplanted a piece of the ninth rib into the nose for saddle-back deformity. Formerly the only remedy for this condition (usually caused by a destruction of the nasal septum from syphilis) was the injection of paraffin, which, on account of the lax condition of the tissues, often spread out into the face, creating "paraffin nodules." The operator who wishes to construct a nose from a rib must understand thoroughly the principles of general surgery.

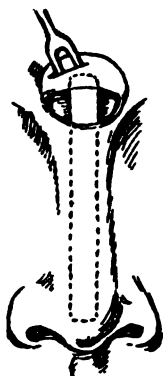
Carter describes his operation as follows: "First, it should be remembered, in transplanting bone, that strict asepsis is absolutely essential; the slightest transient infection means death of the bone-

graft and its subsequent absorption; therefore the greatest care should be exercised in every detail of the operation.

"No syphilitic patient should be operated upon unless he is in a good physical condition and we are satisfied that his disease is in a quiescent state, the Wassermann test being negative.

"*Preparation of the Patient.*—Several hours before the operation the skin over the nose, face, and the right side of the chest is scrubbed with green soap, followed by alcohol. A wet dressing of bichloride, 1 to 5000, is then applied. Just before the operation both operative fields are painted with tincture of iodine and the eyebrows are covered with collodion. After the operation begins no solution is used except sterilized physiological saline solution (salt, 9 Gms.; sterile water, 1000 Cc.).

FIG. 2.



Carter's operation—transplanting rib for saddle-back deformity.

"*Technic of Operation.*—A curvilinear incision (Fig. 2), convexity downward, is made between the eyebrows; this incision extends down to the periosteum over the frontal bone. Lifting the flap up, a transverse incision is made through the periosteum and into the bone in order to favor osteogenesis at this point. This incision corresponds to a line connecting the two cornua of the semilunar incision, and is at a point just below the glabella. Above this incision the periosteum is elevated for about three-eighths of an inch. With the sharp elevator devised especially for this purpose, the skin and subcutaneous tissue is then elevated over the dorsum of the nose, and to an extent corresponding to the degree of deformity, over the sides of the nose and in some instances over the cheeks. If any of the nasal bone is

FIG. 1.



Rhinophyma.

FIG. 3.



Saddle-back nose (author's case).

FIG. 4.



**Same case ten days after operation.
Result excellent.**

FIG. 5.



Saddle-back nose, extreme type, due to syphilis. In this case the transplant was a failure.

FIG. 6.



The nose was misplaced to the left, due to old fracture. Corrected by operation. (Author's case.)

FIG. 7.



Cohen's case before correction.

FIG. 8.



Cohen's case after correction.

left, its periosteum should be elevated so that the bone-graft, when it is introduced, will lie in close contact with the bone and its torn periosteum.

"The nose having been prepared for the reception of the graft, we proceed to remove about two inches of the ninth rib, preserving the periosteum on the outer surface. This piece of rib is then split in its transverse diameter, the outer half is shaped to suit the deformity, and the cancellous tissue is scraped away, leaving only a thin layer of compact bone.

"Without removing the blood, which by this time has accumulated in the wound in the nose, the bone-graft is inserted nearly to the tip of the nose, and the upper end is carefully placed beneath the periosteum over the frontal bone. The semilunar flap is then brought down into its place and the wound closed with horse-hair sutures. A collodion and gauze dressing is applied. The sutures may be removed on the fifth day, but great care must be exercised not to disturb in any way by manipulation the blood-clot which has formed about the graft. The blood-clot seems to favor osteogenesis.

"When we get primary union there is no reaction of the tissues due to the presence of the bone-graft; healing is usually complete in ten days.

"If there are any signs of inflammation, even if the skin wound has healed promptly, the wound should be opened up. Unless the infection is quickly controlled the graft should be removed at once, for infection means death of the bone."

The writer has operated upon four cases of saddle-back deformity by the above method. The first case (see Figs. 3 and 4), operated upon three years ago, was seen a short time ago. Her nose is in excellent condition. Fig. 5 represents a saddle-back nose in which infection took place after operation.

The rhinologist is frequently consulted by patients whose noses have been fractured some time before, resulting in a deflection of the entire nose to one side of the face. It is important to know how to correct such a deformity. Here again general surgical principles must be applied, the variations in technic depending on the individual case.

In most fracture deformities the featural deviation is due to a

deflection of the septum; but in a few instances the nasal bones have been fractured or the "nasal bone arch" has been misplaced. In correcting such a deformity the surgeon must often work intranasally and extranasally. In one instance in which there was a set depressed fracture of the nasal bone on one side the periosteum was separated from this bone intranasally, the bone severed with a chisel from its attachment and replaced. The result was excellent. But not all cases are so easily done. In the case illustrated (Fig. 6) the entire nasal bridge due to injury had been swung to one side. The following operation was performed:

A half-inch incision was made with a fine knife down the centre of the nose from just above the V of the nasal bones. This was deepened down to the periosteum, which was separated over both nasal bones. A small chisel was inserted to the outer attachment of these nasal bones (where it had originally been attached to the lachrymal bones) and the bones were freed at this place. As the "nasal bone arch" was still held by the deflected septum, a small incision was made into the nose just below the junction of the two nasal bones, and into this was inserted a V-pointed chisel, which severed the upper from the lower portion of the septum. We now had a loose fragment composed of the two nasal bones and the upper part of the septum which could be placed in proper position. The wound was closed with fine silk and the parts were held in place with adhesive plaster. At the end of a few days the parts had set in proper position.

In many of these cases intranasal deformities are present which need correction at the same time, and very often excellent results can be obtained by intranasal operations upon the septum and also by intranasal manipulation of the nasal bones. Cohen, of Baltimore, in his paper on "Corrective Rhinoplasty," says: "Lateral deformity is characterized by a displacement of the nose to one side of the middle line of the face, thus producing a most unsightly appearance. The entire nose is at times bent toward one side. In other instances the bony portion is bent toward one side, while the tip curves in the opposite direction, thus causing the nose to appear twisted. Such a nose presents a very curved dorsal outline, and is usually associated with a marked septal deflection which obstructs nasal breathing. Again, a hump or prominence is not uncommon on one side of the

nose at the lower end of the nasal bone, making the nose appear very large and broad at this point. In all cases where the entire nose is deflected there is considerable difference in the breadth of the two sides, the side to which the nose is bent being much narrower than the other.

"While overdevelopment of the framework on one side of the nose may account for some of these deformities, the vast majority are the result of old, unreduced fractures and dislocations.

"A satisfactory cosmetic effect in these operations depends upon the free mobilization of the entire bony and cartilaginous framework, the proper placing of the nose in the middle line of the face, and its retention there with some suitable apparatus.

"It is generally conceded that nasal breathing should be restored by correcting any existing septal deviation before attempting to operate for the external deformity. Berens corrects both with one operation. Roe and Joseph recommend a preliminary submucous resection in many cases. The writer has not been able to obtain satisfactory results, so far as the septum is concerned, with the Berens method, and is also convinced that a classical submucous resection is not advisable where there is a very marked deflection of the triangular cartilage, for the reason that the removal of a necessary amount of this cartilage often too greatly weakens the support of the nasal tip. Therefore, after undermining the mucous membrane of the septum on both sides, as is done for the regular window resection, I remove only sufficient cartilage from the extreme summit of the deflection to permit an approximation of the edges of the gap so made after the septum is straightened. The resiliency of the bent cartilage is further overcome by incisions through it, so placed that when the cartilage is straightened there is no tendency to resume its old curved position.

"Any curved condition in the perpendicular plate of the ethmoid may be overcome by cutting partly through it with the Struchen scissors and forcing it toward the middle line with the periosteal elevator. Should the vomer below then be out of alignment, by severing its attachment to the floor of the nose with hammer and chisel it also can be forced into the middle line. The mucous membrane is now replaced over both sides of the septum, the incision sutured, and both nasal fossæ packed in the regular way for forty-eight hours.

By this procedure we have been able to obtain a perfectly straight septum, and have found, moreover, that the support of the tip was firmer afterward than before operating.

"After allowing three or four weeks for healing of the septum we have proceeded in most cases very much after the method of Berens: Under ether anæsthesia a posterior nasal tampon is introduced, and with the Adams forceps, one blade of which is covered with rubber to protect the skin on the outside of the nose and the other blade introduced within the vestibule of the nose, the nasal bones are grasped, first one and then the other, and fractured at their articulation with each other and with the frontal bone. With these same forceps, minus the rubber covering on the blade, one blade in each nostril, the nasal spine of the frontal is mobilized and the perpendicular plate of the ethmoid fractured freely just back of the nasal spine. The nasal processes are then separated at their attachment from the body of the superior maxillary bones with hammer and an ordinary Hajek chisel. Should there still exist any projection or hump on the side of the nose, by placing a chisel handle covered with rubber tubing against it and giving it a smart tap with the hammer mobilization may be completed (Figs. 7 and 8).

"So much force is at times required in fracturing these bones that, observing the operation, one might suppose the nose was being torn from the face, yet it is indeed surprising to note how trifling is the reaction following. Once sufficiently mobilized, the nose may readily be placed in the middle line and moulded into proper shape, using for the purpose a small, dull elevator on the inside and the thumb and index-finger on the outside. The vestibule is then lightly packed with iodoform tape and the copper saddle placed over the nose. By making tension of the adhesive strip holding the saddle a bit greater on one side than on the other it is easy to overcorrect the displacement somewhat, and this is always advisable."

The operation for "hump-nose" is very simple. Intranasally the periosteum is separated from the "hump" after the skin is separated as far as necessary. When the hump is free it is sawed off and removed. The surface is rounded and smoothed with a suitable file. The operation can be done externally through a small external incision. In cases where the nose is too long the external operation is preferable (Figs. 9 and 10).

FIG. 9.



Cohen's instruments for plastic work.

1950

INTRANASAL SURGERY

The technic of intranasal surgery has changed markedly during the past decade. Formerly work was performed in a haphazard manner with the idea in mind to give better breathing space, no matter how much traumatism or destruction of tissue was caused by doing so. The results were often appalling. But we must remember that such work was performed by men who were self-made surgeons, many of whom were forced into this surgical work against their will.

FIG. 10.

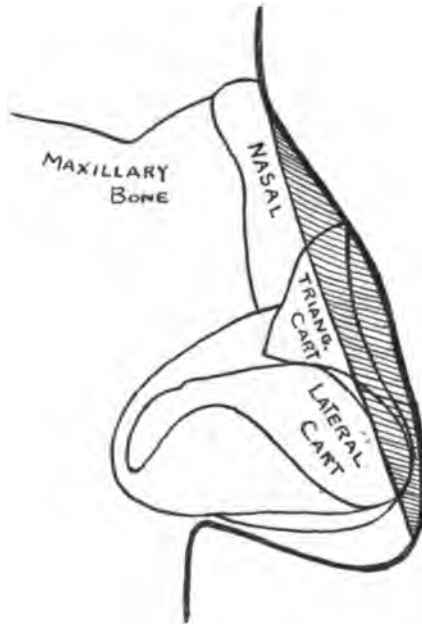


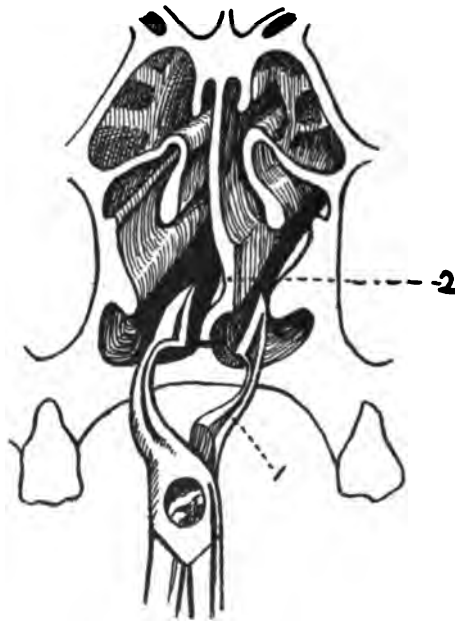
Diagram showing part to be removed in hump-nose. (After Cohen.)

We have but to point to the surgical work on the nasal septum to illustrate the point. Until within recent years the Asch operation (Fig. 11) was the operation *par excellence*. This consisted in grasping the deflected septum on either side, fracturing it, resetting it in position, and holding it in place for weeks with suitable splints. Perforations were common, failures were usual. To-day the rhinologist employs the submucous resection or one of its modifications almost entirely. The trend in the beginning was towards radicalism—removing as much of the septum as possible; to-day the trend is toward

conservatism—removing only so much of the septum as is necessary to obtain the desired result. The rhinological surgeon nowadays looks at even a slight perforation as a gross error in technic, though this perforation causes no symptoms. The change has been brought about by those men who have been surgically trained to look upon their work from the viewpoint of perfection.

One of the most important surgical procedures, from the standpoint of the rhinologist, is that devised by Yankauer for the relief

FIG. 11.



The Asch operation, no longer used for correcting septal deformities. (After Ballenger.)

of lachrymal sac disease by intranasal surgery. The coöperation of the ophthalmologist and rhinologist in the relief of obscure eye conditions is being appreciated more and more. The opening of the sphenoid sinus has cured many cases of optic neuritis and beginning atrophy of the optic nerve. Stubborn cases of conjunctivitis have been relieved by the removal of obstructions in the nose and throat.

The majority of cases of stenosis of the lachrymal duct are due to intranasal conditions. "The fact that the lachrymal canal duct is separated from the nose and its accessory cavities by a bony parti-

tion which is often quite thin and compressible, and sometimes dehiscant, is the basis of this relationship."

Yankauer's technic is as follows: "Previous to the operation the patient receives an injection of morphine or morphine-scopolamine. The patient is placed in the semi-recumbent position on an operating table, the operator standing by his side. This position is desirable because the field of operation is located so far anteriorly in the upper part of the nose that the operator's eye must at times be on a level with the patient's chin.

"The interior of the nose is anesthetized with a solution of 10 per cent. cocaine and 1 to 2000 adrenalin, by spray or application in the usual manner, special attention being given to the under-surface of the lower turbinal. If the lachrymal canal is pervious, a weak solution of cocaine-adrenalin may be injected into the canal through the lower punctum. If it is not pervious, an attempt may be made to inject the canal from below, after locating its nasal orifice with the Holmes nasopharyngoscope. These measures usually render the field of operation insensitive and ischemic, but if necessary they may be supplanted by subperiosteal injections of weaker solutions along the line of incision in the nose, and upon the outside of the nose below the inner canthus.

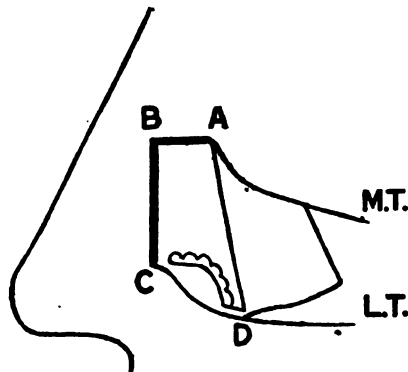
"A self-retaining speculum adds to the convenience of the operator. As the outer nasal wall is directed obliquely backward and outward from the nostril, a better exposure is obtained if the septum is retracted toward the opposite side. For this reason a speculum which opens the nostril from side to side, like Myles's speculum, is preferable, even though it must be held in place by an assistant. Freer's retractors can also be used.

"The incision is begun at the anterior end of the attachment of the middle turbinate bone with an angular knife. It extends horizontally forward for a distance of 0.5 Cm. From this point it is continued downward with an ordinary scalpel to the anterior end of the attachment of the lower turbinal, and then backward along the extreme edge of the lower turbinal for a distance of about 2 Cm. (Fig. 12, A, B, C, D). The incision is made down to the bone, and the irregular mucoperiosteal flap thus outlined is elevated. The lower half of the lower turbinate bone is very rough, and the separation of the mucoperiosteum requires a sharp elevator. Occasionally it is

necessary to facilitate matters by cutting with the scissors the prolongations of periosteum which extend into the deep pits on the surface of the bone. The flap is turned backward, its upper part being tucked under the middle turbinate, where it is held out of the way during the entire operation.

"The mucoperiosteum is then separated from the outer surface of the turbinal in order to remove the anterior third of the bone. As the outer surface of the bone is just as rough as the inner surface, the mucoperiosteum is elevated for a short distance at a time and the bone punched away in small pieces (Fig. 12). The preservation of the mucous membrane of the outer surface of the lower turbinal is necessary to prevent contraction of the nasal orifice of the canal after

FIG. 12.



Yankauer lacrimal duct operation. (First step.)

the operation. When the anterior end of the turbinal is much hypertrophied, its lower edge may be removed *in toto* with the punch-forceps.

"The line of attachment of the turbinate bone to the outer nasal wall curves upward from its anterior end, and the bone must be removed close up to its attachment and as far back as the posterior margin of the nasal orifice of the duct.

"When the lachrymal canal has not been cocainized and adrenalinized, owing to the obstruction at the neck of the sac, there are apt to be some pain and considerable bleeding from the veins surrounding the membranous canal at this stage of the operation. In order to inject the lower part of the canal from below, it is necessary to locate its nasal orifice. This is done by raising up the outer turbinal

mucous membrane with an elevator and inserting a probe, the end of which is bent upward for about 4 Mm. If the probe is inserted anteriorly and moved backward, it will glide over the valve or fold of Hasner and will not enter the canal. It is preferable to insert the probe some distance back and to move it forward, so that its end will pass under the fold of Hasner and enter the canal. When the nasal orifice of the membranous canal cannot be found, the canal may be injected by plunging a hypodermic needle, bent at right angles, through its wall at the nasal orifice of the bony duct.

"The precise localization of the nasal orifice of the bony duct is an important step in the operation, as the removal of the inner wall of the duct is begun at this point. When the orifice is normal in size its localization is not difficult; but when it has become stenosed as a result of the disease it is not always easy to locate it with certainty. After the removal of the anterior third of the lower turbinate bone a stump is left which forms an elevation on the outer nasal wall. Below this line of attachment the mucous membrane of the outer turbinal surface is reflected upon the outer nasal wall. The nasolachrymal duct, as above described, is continued below the lower turbinal in the form of a groove, whose anterior edge forms a distinct ridge on the outer nasal wall in front of the orifice of the duct. If, now, the right-angled probe is placed on the outer nasal wall just below the stump of the turbinate, above the reflection of the mucous membrane, in front of the orifice of the duct, with its point directed outward, and then moved backward, the point will glide over the ridge and will suddenly disappear in a lateral direction in the hollow of the nasal duct. The point of the probe can be turned upward, and by moving it back and forth and from side to side definite information as to the size, shape, and location of the orifice is obtained.

"The next step is the removal of the inner edge of the nasal orifice of the duct. This is a thick, hard piece of bone. The use of a chisel for this purpose would endanger the antrum. A suitable forceps could not be found, so that it was necessary to design a special forceps for the purpose. This forceps has a small but stout jaw, turned upward nearly at right angles to the shank. After separating the membranous canal from the duct by means of the right-angled probe or the hook-shaped elevator, the male blade of the forceps is introduced into the duct and the bone cut through.

"The anterior edge of the nasal orifice is now removed. This must be done with the chisel, the most suitable being a gouge, bevelled from the inside. As the chisel-cut ends in the incision previously made by the forceps, the antrum behind the orifice cannot be injured. To avoid injury to the antrum in front of the duct, which may occur when a deep infra-orbital recess lies close to the surface of the nasal wall, the bone is removed gradually, in thin shavings, the probe being used after each cut. The cut in the bone is deepened until the entire width of the membranous canal is clearly visible. Injury to the membranous canal can and should be carefully avoided.

"The management of the nasal orifice, especially when it is small, is one of the chief difficulties that is met, but when once the membranous canal has been brought clearly into view the operation proceeds with greater celerity.

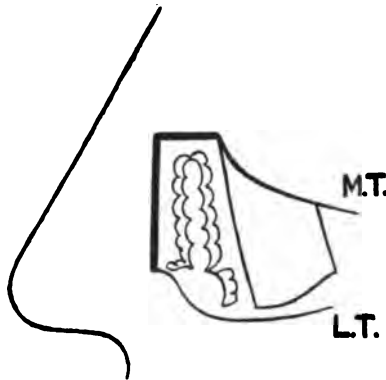
"Above the nasal orifice the inner wall of the duct is thin, the anterior wall thick and dense. The inner wall is removed with the forceps, and, to avoid injury to the ethmoid cells which lie behind the duct in the middle part of its course, this is done first, before the corresponding part of the anterior wall is attacked with the chisel. As the upper parts are reached an ordinary straight nasal punch is more easily adapted to the parts than the special forceps.

"When the neighborhood of the orbital orifice is reached the gouge cannot be applied to advantage. For the enlargement of this orifice the guarded chisel which the writer devised some years ago for the enlargement of the frontonasal duct is the most efficient. When the foot of this instrument is passed through the orbital orifice it can be seen and felt through the skin below the inner canthus of the eye. The upper limit of the cut in the bone is reached at the level of the attachment of the middle turbinate bone. When sufficient bone has been removed the entire lachrymal passage is clearly visible, from the middle of the lachrymal sac down to the nasal orifice (Fig. 13).

"The next step in the operation is to slit open the entire membranous passage. As the inner wall of the canal is continuous with the mucoperiosteum of the outer turbinal surface, the incision is begun at the lower edge of this mucoperiosteum with a curved nasal scissors. The nasal orifice of the canal is sometimes obscured by the presence of a well-marked fold of Hasner. This is cut through with

the scissors. When there is no stenosis at the neck of the sac the incision is extended up to the middle of the sac with scissors. When the sac is filled with pus or mucus its lumen is separated from the lumen of the canal by a complete stenosis near the neck of the sac, caused by inflammatory adhesions of its walls. So long as the fluid remains in the sac these adhesions cannot be separated. The sac is therefore opened by inserting a hook-shaped knife into it as high up as possible, and cutting downward to the neck. After the contents have been removed (by irrigation if they are purulent) the right-angled probe is inserted into the sac with its point downward, and as the adhesions are separated the neck of the sac is opened with the

FIG. 13.



Yankauer lacrimal duct operation. (Second step.)

scissors, or by cutting down on the probe with a small knife (Fig. 14). The incision in the membranous canal is made as far back on its inner wall as possible. The part of the canal wall in front of the incision is brought forward and laid against the bone.

"The mucous membrane of the outer nasal wall, which during the entire operation has been tucked away under the middle turbinal, is now brought forward and returned to its original position. It may be held in place by a single suture at its anterior inferior border.

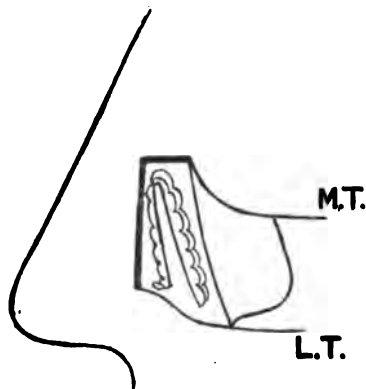
"When there is pus in the lachrymal sac, a piece of the flap, about 4 Mm. in diameter, is removed from its upper corner in a position corresponding to the incision in the sac, to provide direct drainage into the middle meatus of the nose.

"After the operation the nostril is packed with gauze to prevent

hemorrhage and to insure perfect coaptation of the entire flap. The packing is removed after twenty-four hours and the lachrymal passage irrigated with normal saline solution. When there is pus in the sac, the opening in the middle meatus remains patent. In such cases the sac is irrigated daily with the salt solution.

"During this time there is some epiphora, and when the patient blows his nose air is driven through the fistula into the eye. When the suppurative inflammation has subsided and drainage has become reestablished through the natural passages, the opening in the middle meatus closes. To determine when this opening has completely closed I have employed the following test: A pledget of dry absorbent cotton is inserted into the middle meatus, and a second one in the

FIG. 14.



Yankauer lacrimal duct operation. (Third step.)

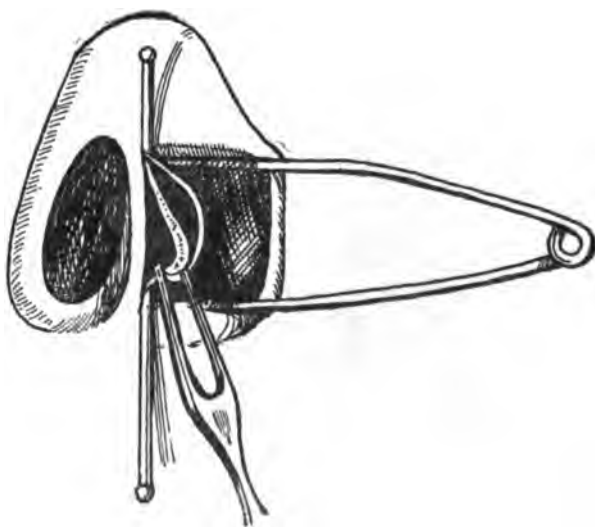
lower meatus, below the lower turbinal and at about its middle. A thin, watery solution of starch is then injected into the sac through the lower punctum. After a few minutes the cotton pledgets are removed and tested for starch by means of a solution of iodine. When the pledget from the middle meatus remains unaltered by the iodine, while that from the lower meatus turns blue, we know that none of the starch solution escaped into the middle meatus, and that the lachrymal passage has resumed its normal function."

The submucous resection of the nasal septum is universally recognized to-day as the most conservative operation upon the nose. But, even with our advanced knowledge of this work, new points are brought out yearly which make the work easier and finer. The

essential point of the operation is to remove the deflected piece of bone, separated from its periosteum, through a "window" or incision (Fig. 15) made through the mucous membrane and perichondrium over the fore part of the cartilage. The perfection of the operation depends on the skill of the operator.

Local anæsthesia varies with different operators. But the most satisfactory anæsthesia is by the infiltration method suggested by King, which the author has used for some time. The patient should be given an opiate a half hour before the nose is sprayed with a dilute cocaine solution, and then the entire septum should be infiltrated

FIG. 15.



Submucous resection. (After Ballenger.)

submucously with a one-quarter of one per cent. cocaine solution to which are added a few drops of adrenalin. This not only produces anæsthesia and ischæmia, but raises the perichondrium and periosteum from the cartilage and bone, so that the separation is done much more readily. Many operators do this work in the recumbent position instead of having the patient sitting up in a chair—a much easier position for the patient. The time will come when all nasal operations will be performed with the patient flat on the operating table. Some operators, after resecting the cartilaginous portion of the septum, mould the part resected until it is straight and reinsert it.

Many deflections occur on the floor of the nose. These do not require, as a rule, extensive operations, and more of these "spurs" are operated upon submucously now instead of being merely sawed off.

Perforations of the septum from submucous operations still do occur. Aside from being an error in technic, they mean very little, but once in a while it is necessary to correct the trouble on account of the accumulation of crusts or because of a whistling noise when the patient breathes. Hazeltine has devised the operation (Figs. 16 and 17) of bringing down a mucous membrane flap from another portion of the septum and suturing it in place. Suturing in the nose is not a simple procedure, but well-devised instruments make it possible in many cases.

FIG. 16.



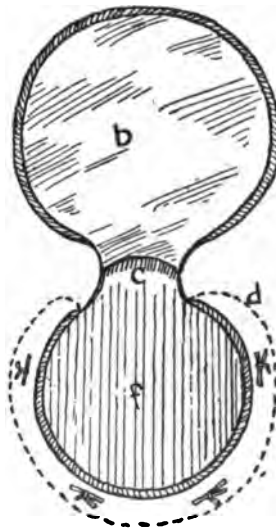
Hazeltine's flap operation for perforation of the septum. (After operation.)

The inferior turbinate bone, with its covering mucous membrane, is recognized as an important part of the nose, on account of the "filter action" of the mucosa. However, in well-defined cases of hypertrophy of this membrane a portion of it must be removed. A submucous operation here again is permissible. The bone and the mucosa on its free side and below it are removed, the flap remaining (the upper surface) being folded to form a new and smaller surface. The posterior tip gives the most trouble, often enlarging and lying free and oedematous in the posterior nares and nasopharynx. When once the mucosa is shrunk with cocaine and adrenalin it is difficult to remove the posterior tip. Here, again, infiltration anaesthesia helps; for by filling this tissue with a watery solution it becomes

large enough to be seen and readily grasped. A cut is made into the turbinate at its posterior third with angular scissors down to the bone. The wire loop of a nasal snare is passed round the membrane to be removed, the shank of the snare engaged in the incision made and the part thus snared off. When loose pieces of tissue remain it may be necessary to "bite" them off with a suitable biting forceps.

Removal of a portion or the whole of the middle turbinate is now done in a most precise manner. This bone, with its mucous covering, is often the obstructing agent in various affections of the sinuses. By removing it access is in many cases readily gained to the frontal

FIG. 17.



Haseltine's operation. (After Ballenger.)

duct, and only by this operative interference can one gain a proper view of the ethmoid cells and the sphenoid cavities (Figs. 18 and 19).

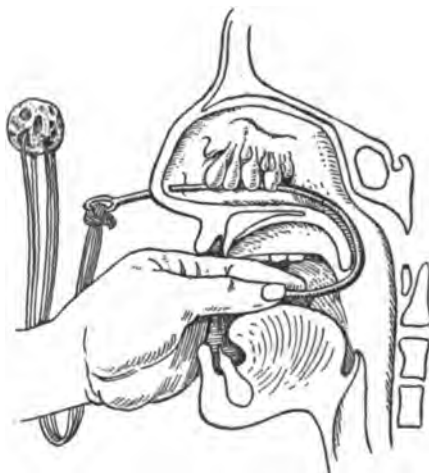
A great advance has been made in the surgery of the nasal sinuses. To-day diagnostication of diseased conditions of these parts can be obtained from carefully-taken X-ray plates. The technic of operations on the frontal sinuses and maxillary antra has not changed much within recent years except in minor details. However, the surgical treatment of the ethmoid cells and sphenoid sinuses deserves special mention.

Formerly suppurative conditions of the ethmoid cells was treated

by removal of the middle turbinate and curettage of the cells, thus breaking down the frail septa between. To-day we have recourse to the procedures of Ballenger and Mosher, whereby the ethmoid cells are removed *en masse*.

Ballenger describes his operation as follows: "The general method of procedure is based upon the anatomical observation that the ethmoidal cells have but three planes of attachment, namely: (a) To the anterior wall of the sphenoid bone, (b) to the cranial plate, and (c) to the outer or orbital wall of the nose. If, therefore, these three planes of attachment are incised, a large portion of the lateral half of the ethmoid body (including the posterior ethmoidal and one

FIG. 18.



Method of removing polypi from the nose at the time of Hippocrates. (After Wright.)

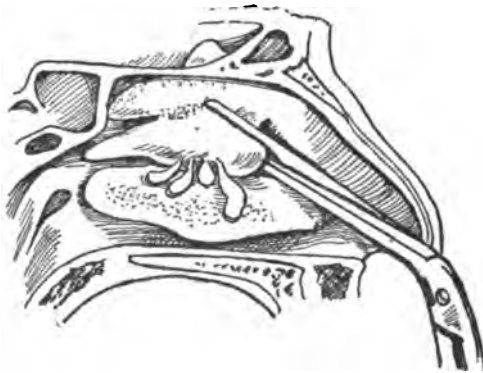
or more of the anterior ethmoidal cells, and the middle turbinated body) is detached within the nasal chambers, from which it may be readily removed.

"The instrumentarium required for this operation consists of one instrument, supplemented by two others, which are only occasionally required. The important one consists of a short blade set at a right angle to a longer blade which is parallel with the shank of the instrument. The short blade makes the incision along the anterior wall of the sphenoid, and is then drawn forward and makes the incision along the cranial plate; when the instrument is drawn forward the long blade makes the incision along the orbital wall and

thus completes the excision of the ethmoid cells and middle turbinated body.

“Technic.”—(1) Anæsthesia is induced by massage of the mucous membrane of the middle and superior meatuses and the corresponding portion of the septum with a small, cotton-wound applicator, the cotton

FIG. 19.

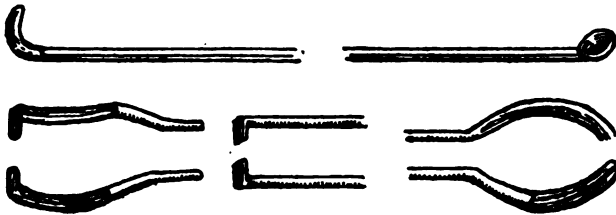


The modern method of removing nasal polypi. (After Ballenger.)

being slightly moistened and dipped in powdered cocaine. The application should be made at intervals of from five to ten minutes to the areas previously named until complete anæsthesia is induced. If preferred, the operation may be done under general anæsthesia.

“(2) The exenteration is accomplished by the following pro-

FIG. 20.



Ballenger ethmoidal instruments.

cedures: (a) Introduce the author's ethmoid knife (Fig. 20) into the middle meatus, with the short blade turned upward until it impinges against the lower portion of the anterior wall of the sphenoid bone or until it engages the posterior end of the middle turbinated body. During this procedure the handle of the instrument is turned

horizontally across the opposite side of the face. The short blade is then forced outward into the tissues in front of the sphenoid.

" This procedure is facilitated by moving the instrument backward and forward over a distance of about one-fourth of an inch, as these movements cause the short blade to penetrate the tissues to the depth of the orbital wall and thus cut the ethmoid cells from their attachment to the sphenoid body. These movements also engage the short blade behind the posterior end of the middle turbinated body.

" (b) The handle of the instrument is then rotated 45 degrees. The short blade is then forced upward to the junction of the anterior wall of the sphenoid with the cranial plate, care being taken to have the long blade pass between the middle turbinated body and the outer wall of the nose. When the operator is assured that the blades of the knife are in their respective positions he should work them upward parallel with the anterior wall of the sphenoid until the cranial plate is reached. The short, right-angle blade should be forced upward in front of the anterior wall of the sphenoid until it strikes against the cranial plate, the long, perpendicular blade resting against the orbital wall of the nose. The blades are not drawn forward as in making a clean cut, but are wiggled or rotated slightly in their respective axes. This is done in order to fracture the cell walls in front of the blades, which then readily cut the mucous membrane. The instrument is thus brought forward to the anterior attachment of the middle turbinated body.

" (c) As the nasal chamber is quite narrow in its anterior portion, the handle of the instrument should be rotated another 45 degrees. This turns the short, right-angle blade downward into the nasal chamber and away from the septum. The knife should then be drawn forward and downward to complete the severance of the tissues. This being accomplished, the instrument is withdrawn through the vestibule of the nose. This movement of the instrument usually delivers the severed ethmoid mass from the nose; otherwise it should be gently seized with forceps and withdrawn.

" If it is found that the specimen is still attached to the nasal walls by some fibres, the blunt hook knife should be introduced between the specimen and the outer wall of the nose and the attachments severed with it.

" (d) The blood should be mopped from the nasal chambers, and

the remaining fragments of cells should be broken down with the curette. This completes the operation.

"The Dressing."—If there is serious hemorrhage, the upper or ethmoidal region of the nasal chamber should be packed with a 1½-inch strip of gauze impregnated with the subnitrate of bismuth powder. The bismuth prevents decomposition and infection, and thus wards off the dangers of septic absorption. The gauze should be introduced against the anterior wall of the sphenoid, and folded and packed until the upper half of the nasal cavity is completely filled with it. Stout dressing forceps should then be introduced beneath the dressing, and the whole lifted in order to compress it into the area which has been operated on. The dressing should be removed in from one to twenty-four hours. The subsequent treatments consist in lightly packing the nose with cotton tampons saturated with a 10 per cent. aqueous solution of ichthyol or of argyrol. The applications should be repeated daily and left in place twenty minutes. This mode of treatment is more effective in removing the secretions and sterilizing the wounded surface than irrigations."

The Mosher operation may be described as follows:

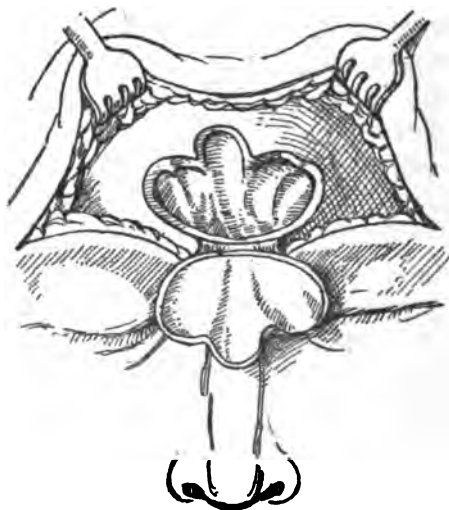
"Technic."—First. Cocainize the interior of the nose or administer a general anæsthetic.

"Second. Introduce a curette into the nasal chamber until the cutting edge of the instrument facing the orbit is above the anterior attachment of the middle turbinate. This area covers the frontonasal canal and the anterior ethmoidal cells draining into it. The bone at this point is usually very thin and easily broken down. In some cases the bone at this point is very dense, thus making it necessary to break through it more posteriorly. Having located the instrument, make gentle but firm pressure toward the orbit, and at the same time withdraw it downward and forward one-fourth to one-half inch. The anterior ethmoidal cells are thereby completely opened. By continuing the curettage in a forward and upward direction the fronto-nasal opening in the floor of the frontal sinus is enlarged and free drainage of this sinus established. The frontal sinus may now be entered with a blunt-pointed frontal sinus probe. Indeed, in most instances a suitably bent, cotton-wound applicator may be easily introduced.

"Third. The next step of the operation is the removal of the posterior ethmoidal cells. This is done with the same curette introduced through the opening already made. The curette is introduced beneath the cranial plate and then brought downward between the orbital and turbinal plates. This procedure is repeated several times until the anterior wall of the sphenoid is reached.

"Fourth. The turbinal plate, consisting of the superior and middle turbinate bodies, is then seized with suitable grasping forceps, and by gentle traction combined with twisting motions is detached from the cranial plate and removed from the nose.

FIG. 21.



Beck operation on frontal sinuses. (After Wright and Smith.)

"Fifth. The entire posterior and anterior ethmoidal regions are again examined by ocular and probe inspection, and all portions of cells remaining are removed."

In both these operations, particularly the former, the operator must have a perfect knowledge of his anatomy and must realize the dangers of operating on parts so intimately connected with the cranial cavity. One is liable to fracture into the orbit—which does no harm, provided the mucous membrane and periosteum remain intact.

External operations for sinus disease are frequently performed, but the writer is glad to say that, now a better knowledge of the pathology of these parts is known and now that patients realize the

importance of early treatment of sinus disease, many of the cases do not go on to the stage where an external operation is necessary. Astringents, suction massage, and the employment of autogenous vaccines in these infections have tended to diminish their chronicity, and many times a small intranasal operation, such as the removal of the anterior half of the middle turbinate, will clear up the trouble.

The external operation of choice in frontal sinus disease (or in pansinusitis) is what is called the Killian operation. This consists in making an incision along the eyebrow, which is continued downward to the lachrymal sac. The incision is deepened through the periosteum of the frontal bone, which is scraped back. The bone is chiselled through and the diseased parts eradicated. Through this opening the other sinuses may also be cleaned out and a large enough drainage opening into the nose established. Where there is disease on both sides the Killian operation has been modified by Beck (Fig. 21), who makes an osteoplastic flap which uncovers both sinuses.

INTRA-ORAL SURGERY

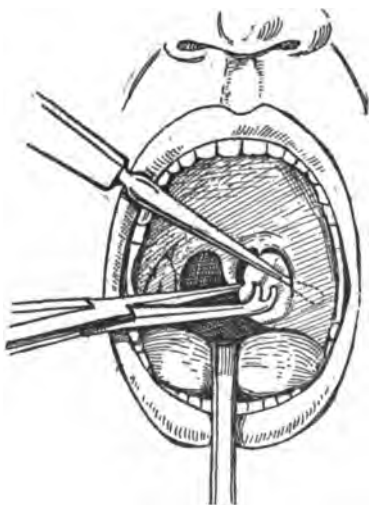
The surgery of the throat is mainly confined to the region of the soft palate and nasopharynx. Except for the major operations for malignant disease, the attention of the rhinologist is confined mainly to operations on tonsils and adenoids.

It is the almost universal opinion to-day that tonsillectomy is preferable to tonsillotomy,—i.e., that the tonsil should be removed with its capsule *in toto*. The means for doing this vary greatly. One class of operators prefers various modifications of the tonsillotome and uses the technic suggested by Sluder, of pressing the tonsil forward against the ramus of the jaw and there engaging it in the instrument. Another class thinks it is better to dissect the tonsil free until it is hanging by a pedicle, which may be cut off in various ways, preferably by a suitable snare. The writer is of the opinion that no set rules should govern the removal of the tonsils. Each case should be judged individually. The best results in the majority of cases are obtained by freeing the anterior pillar and then dissecting the tonsil from its other loose attachments either with the finger, a dissector, or, at times, with a curved scissors. A simple snare can then be slipped over the pedicle. One marked advance may be seen in the treatment of tonsillar hemorrhage which is frequently caused by an abnormal blood-

vessel. Inspection may show the bleeding artery, which is caught with an artery forceps and ligated. If there is general oozing from the tonsillar surface, the pillars may be brought together (possibly a gauze pad being held between them) and sutured with silk.

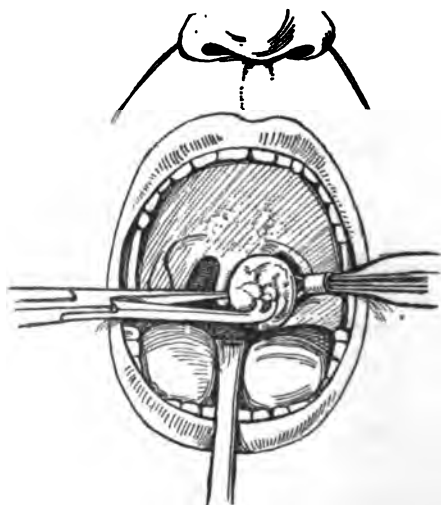
A novel change in the procedure for removing adenoids has been practised by Beck. The technic of the operation is as follows: "Pass the free ends of a rubber urethral catheter (the smaller sizes), one through either nostril, and withdraw them from the mouth, thus crossing the columella of the septum. Put a gauze sponge at this point to prevent too much pressure on the columella. Allow them to remain

FIG. 22.



Removal of tonsil. Separator severing the tonsil from the anterior pillar. (After Wright and Smith.)

FIG. 23.



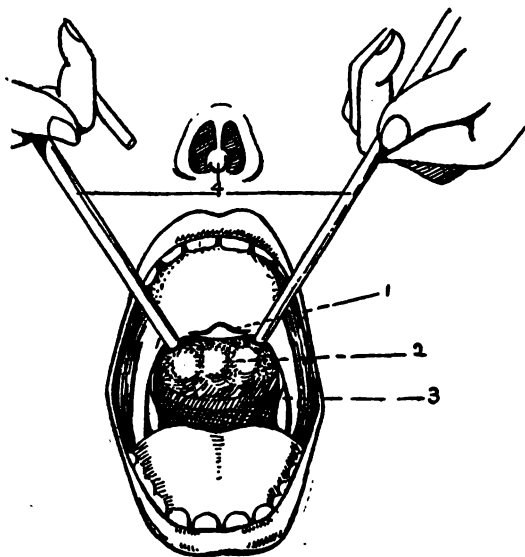
Removal of tonsil. Snare placed around tonsil. (After Wright and Smith.)

in this position while the tonsils are being removed, usually placing them to one side or the other out of the field of the tonsillectomy. As soon as one tonsil is out the end of the catheter corresponding to the side from which the tonsil was removed is drawn taut out of the mouth and over the cheek, while the other end is held. This will bring the pressure from behind forward against the hard palate, and thus stop the greater portion of the bleeding and enable one to do the opposite tonsillectomy with very little interference from bleeding of the tonsil removed. It will also bring the anterior and posterior pillars in opposition, thus closing in the large cavity created by the

tonsillectomy. If the bleeding is profuse, place a small gauze sponge between the two pillars and then by a fine rat-tooth forceps (Tuffier) hold them together, also taking in a small bit of the gauze so that it cannot fall out at the bottom (Fig. 24).

"When both tonsils are excised and the bleeding perfectly controlled the soft palate is allowed to recede, the two pillars liberated by the removal of the Tuffier forceps, and the gauze sponge removed. The assistant then pulls both free ends of the catheter out over the cheeks, causing large exposure. The head is now extended, and the

FIG. 24.



Beck operation for removing adenoids by direct inspection.

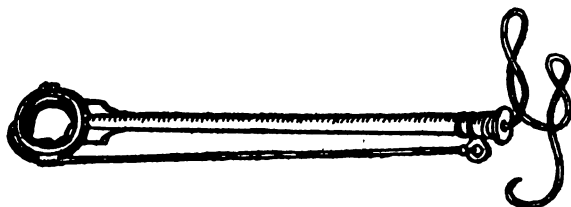
region of the ostia, as well as the highest point of the vault of the pharynx, is seen. One must not look from the side to get the best view of the tubal ends, but straight towards the vault. With a large laryngeal mirror inspection is made of the posterior nares with the entire nasal contents, and the overriding of the adenoid mass into the posterior choanæ is noted.

"The mass is now palpated so as to determine the consistency and the amount of overriding. If the patient is not completely anesthetized, or his pharyngeal reflex not yet completely abolished, the examining finger gains the same impression as when examining the

postnasal space of a conscious patient, namely: the constrictor muscle Wulst folds many times in the form of an incomplete ring. So long as that fold forms, the removal of the adenoids should be deferred and the patient completely anæsthetized, because this muscle fold may be cut and produce symptoms of stiffness of the neck, to which Fein recently called attention but did not explain on this basis.

"The removal of the adenoid mass itself may be done by any method preferred by the operator; but the removal of the remaining portions, especially in Rosenmüller's fossa, should be performed with a straight ring curette, such as it is customary to employ in the curettage of the endometrium. It may be bent to suit any particular shape desired. The pronounced oozing that results from the removal of the central mass is controlled by a gauze sponge mounted on a six-inch artery forceps, by exerting firm pressure for a few minutes, or until the time the patient awakes from the anæsthesia.

FIG. 25.



Ancient instrument for amputating uvula. (After Wright.)

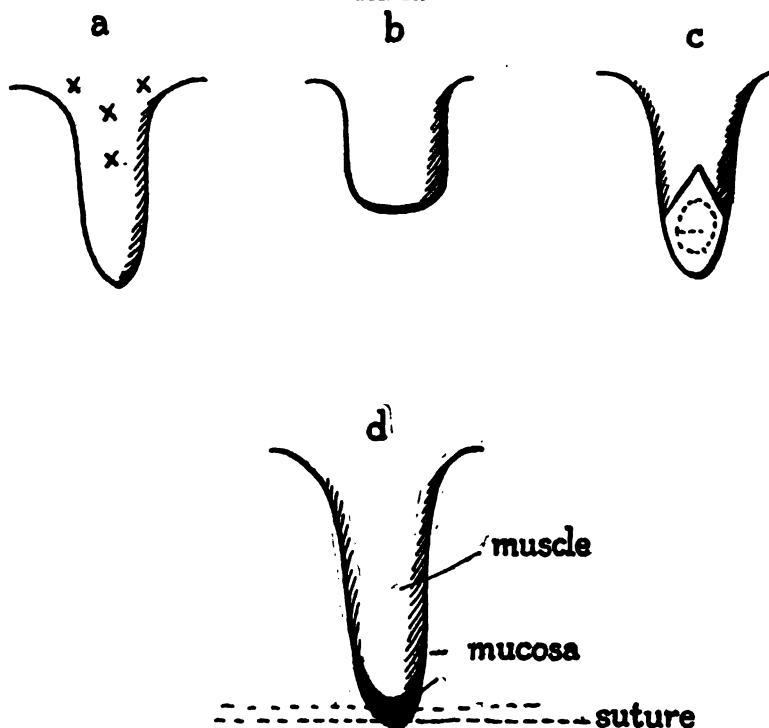
"The instrument that I employ now for the removal of the main mass is an adenoid curette of the St. Clair-Thompson pattern, without a guard, and with the cutting edge formed into a wave blade. The motion of the instrument in the removal of the mass is not in the usual rapid, sweeping movement of the elbow-wrist turn, but is from side to side and slow elbow-wrist turn. The mass is cut off and remains lying practically *in situ*; however, the last cut at the lower margin of the mass may require the use of a forceps to hold it. Shredding of the mucous membrane is not possible under these circumstances, nor is it possible to cut off any of the muscle fibres of the constrictor fold, as I have seen in the operation when done by feeling alone."

The amputation of the elongated uvula (Fig. 25) is usually done with a pair of curved scissors which is supposed to cut off the re-

dundant mucous membrane in a satisfactory manner. The operator attempts to excise more of the mucosa and muscular tissue on the posterior surface of the uvula than the anterior surface. A raw area is left which under the best of circumstances must heal by secondary intention. Oftentimes there is a severe reaction with swelling and œdema of the soft palate.

Realizing the obvious objection to this method (and to other

FIG. 26.



Author's circumcision of the uvula.

similar procedures in which a curved scissors is used on a very movable part), the writer devised the following operation, which has proved very satisfactory: (1) The region of the soft palate is sprayed with a ten per cent. cocaine solution and the base of the uvula painted with pure cocaine crystals. The entire uvula is then anæsthetized by an infiltration anæsthesia of a one-tenth of one per cent. solution of cocaine (Fig. 26, a). The injection may be made with a tonsil-needle,

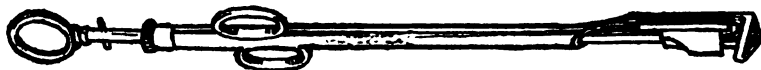
the injection being started at the base of the uvula and progressing downward toward the tip. About 30 minims of solution are used. After the infiltration the uvula will have increased to two or three times its size (*b*).

(2) As much uvula as one wishes to amputate is then ascertained. One wishes to have a uvula remaining as near the normal size as possible. The tip is grasped between the blades of a long artery-forceps after passing it through the oval opening in the uvulatomer, which I shall now describe:

The author's uvulatomer (Fig. 27) works on the same principle as a Mackenzie tonsillotomy, in that the blade works by pushing it to. The blade of the instrument is angular in shape, so that it cuts a V the same as a cigar-cutter cuts a V out of a cigar. The instrument can be readily taken apart for cleaning.

(3) When the uvulatomer is once in place the blade is strongly pushed to, thus excising the portion within the blade (*c*). But the

FIG. 27.



Author's uvulatomer.

peculiarity of the instrument is soon apparent to one using it, for more of the mucosa is removed than muscular tissue—precisely what one wishes, as the redundancy and laxity of the mucosa are what usually cause most of the trouble. If the cut has not been made all the way through, it is a simple matter to finish it up with a sharp scissors.

(4) When the portion desired is excised, one finds that the remaining mucous membrane covers the stump of muscular tissue. This mucosa is gathered together and united with 00 catgut, tying one knot only, so that the suture will surely come away by itself. This suture may be placed with any fine-curved needle (preferably an enterostomy needle) used on any needle holder (*d*). By the method of anæsthesia just described there is absolutely no pain, and, for the purpose of suturing, the uvula can almost be brought out of the mouth.

(5) No after-treatment of any kind is necessary except a gargle of peroxide of hydrogen for the following twenty-four hours.

INTRALARYNGEAL AND INTRATRACHEAL SURGERY

Within the past decade surgery of the larynx has undergone a marked change. Until the invention of the direct laryngoscope any pathologic condition within the larynx which necessitated operation had to be removed by the so-called indirect method; *i.e.*, the

FIG. 28.



Killian suspension laryngoscope.

operator viewed the larynx through a mirror held against the palate, and therefore had to manipulate his instruments at right angles to his plane of vision. Operations of any sort were difficult, and very often destruction of normal tissue occurred. The first direct laryngoscopes of Killian and Jackson paved the way toward a more exact surgery of these parts. Through these instruments, illuminated

electrically, one was able to carefully inspect the larynx and, after a certain amount of practice, to remove abnormal growths. Through the lumen of such instruments electrically-lighted tubes could be passed through the glottis down into the trachea and bronchi. Thus a new field was opened up to the laryngologist, who now could locate and remove a foreign body, such as a safety-pin, tack, false tooth, etc.

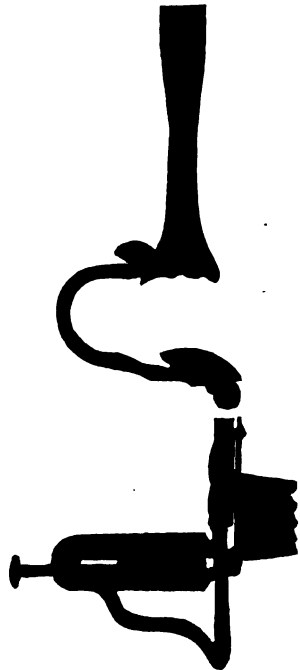
However, the use of these laryngoscopes could only be made per-

FIG. 29.



Killian suspension laryngoscope.

FIG. 30.



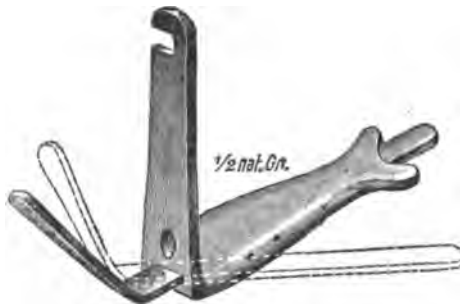
Killian suspension laryngoscope.

fect by long practice, and a number of assistants were necessary to hold the patient's head, to keep up traction on the handle of the instrument, etc. The procedure was always extremely tiring. But, fortunately, Killian again came to the front with his suspension laryngoscope, by means of which the patient "suspends" himself, easily and comfortably and in such a way as not to aggravate the tension on the muscles of the neck.

The suspension laryngoscope (Figs. 28, 29, and 30) consists of an especially-devised tongue spatula and mouth-gag (Fig. 31), which hang, by means of a pivot, at right angles to a long, swinging bar which fits into a permanent standard attached to the operating table. The patient lies on his back on the table with the head hanging over the edge. The tongue spatula is inserted into the mouth to the base of the tongue and the mouth-gag adjusted. The head hangs from the swinging bar attached to the standard. If the epiglottis is in the way, an epiglottis retractor may be used. The position is not particularly uncomfortable for the patient, and the operator thus has both hands free for operative work. Illumination is supplied from an electric head-lamp on the operator's head.

It remained for Dr. Lynch, of New Orleans, to develop a proper

FIG. 31.



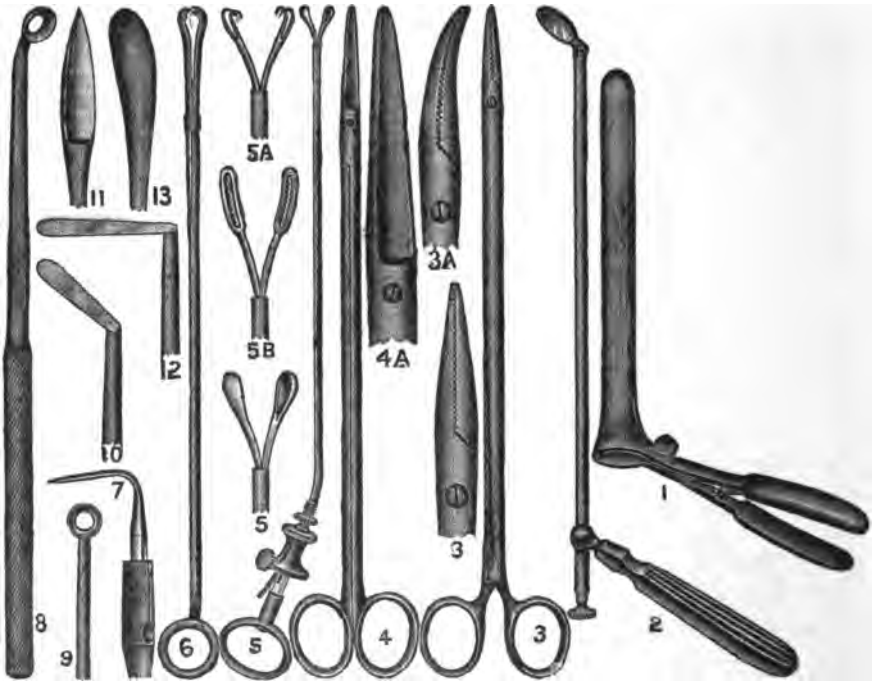
Spatula for Killian apparatus.

operative technic for operations on these parts. Formerly the work was done with specially-devised instruments which had for their object the biting or tearing away of the pathologic tissue. Lynch felt that it was now possible with "suspension" to do the work in a more precise manner, and therefore he devised an excellent set of instruments which allow one to work with the nicety of the intra-abdominal surgeon. I shall quote from Lynch's recent paper:

"The type of instrument that has served us up to this time is some one of the hundred varieties of forceps, be they pinching, biting, punching, or the double curette—dull or sharp. Briefly, the technic is to grab more or less accurately, and pull, or twist, or both, let come what will—and therein lies the most unsurgical part of this type of surgery. We should criticise our colleague, the laparotomist

or gynecologist, for such a method in dealing with similar lesions in his domain. I hope to convince you that the way is now clear to deal with the larynx in exactly the same manner as our brothers do in other parts of the body; and with these instruments I can dissect accurately, ligate bleeding points, cover raw surfaces by suture, and do plastic work with almost as much ease and quite as much accuracy as my brother surgeon who works in the vagina, rectum, or abdominal cavity. The suspension laryngoscope is necessary to all

FIG. 32.



Lynch's instrument for operations upon the larynx under suspension. The instruments are made of gun metal to eliminate reflection.

this work, and I use it in its simplest form, with an improvement that to me is essential (Fig. 32).

"The primary requisite is perfect quiet of the part, so that the selection of an anæsthetic and, above all, its administration are most important. For all procedures that are to be somewhat prolonged and in all children I much prefer a general anæsthetic, though I have kept one patient on the suspension apparatus for one hour and ten

minutes under local anæsthesia with perfect comfort during the whole time.

"In local anæsthesia, with the patient in sitting posture, administer a morphine-scopolamine tablet of appropriate dose one hour before the operation. Then apply to the uvula and postpharyngeal wall a ten per cent. cocaine solution with such care as to avoid gagging or coughing; to avoid these reflexes at the start is to have comfort and quiet throughout the performance. Follow this with three drops of the same solution from a laryngeal syringe upon the epiglottis, and wait three minutes, requesting the patient to avoid swallowing and to spit out the excess. Next application, five drops into the larynx over the cords and down the trachea, requesting the patient to cough out the excess. From the sitting posture the patient is then put upon the table, the speculum introduced carefully and quietly, adjusted perfectly and slowly, and the larynx tested with a cotton mop. If not perfectly quiet, more cocaine of the same strength is applied until anæsthesia is perfect and we can then proceed to work.

"I have removed a single, pedunculated fibroma, multiple papillomatous vocal nodules, and specimens for microscope in adults with complete satisfaction to myself and comfort to my patients with this method of anæsthesia.

"General anæsthesia is more satisfactory for malignant tumors, papilloma in children, for plastic work, and is essential in all cases where perfect relaxation of the parts concerned cannot be secured by local means. I select ether in every instance, administered with the Cain-McDermott warm ether-vapor apparatus, under the supervision of a trained anæsthetist.

"As perfect quiet is of greatest necessity, I insist on my patient being kept continuously in the surgical stage of anæsthesia, securing perfect relaxation of the parts, conducing to the most accurate work, and surrounding the patient with that type of anæsthesia which we recognize as the safest.

"Crowding the patient under to the limit and working during the period of recovery—and, if that period is too short, crowding under again—is, to my mind, neither wise nor safe. This type of anæsthesia will develop for the operator many disturbances just at the wrong time, and is surely most dangerous for the welfare of the case.

"As our experience increases with the use of the warm ether

vapor we are realizing that the tracheobronchial irritation following the use of this drug is decidedly overrated—none having occurred in nearly sixty anæsthesias of this type. In order to eliminate the reflex element in the larynx even under general anæsthesia, I paint the parts carefully with a ten per cent. solution of cocaine, using only one application, taking particular care that none reaches the trachea, heeding Jackson's advice regarding the cough-reflex in larynx operations. I then prepare the field by painting these surfaces again with a twenty per cent. solution of argyrol freshly prepared. Whether this limits or prevents infection I cannot say; so far I have had none, and I am inclined to think I get less inflammatory reaction.

"I find some form of suction apparatus necessary to take away the secretions that come from the salivary glands and œsophageal mucosa, also to care for what bleeding occurs, and one can, with ease, pick up small fragments of tissue that may drop and remove those blood-clots that form and lie on the posterior wall of the trachea. The careful use of the suction tube for cleansing purposes, as against sponges, eliminates one of the factors of traumatism, to which so little attention has been paid in laryngeal work, besides giving the operator the cleanest field possible for his manipulations.

"Having obtained a perfect view of the larynx with that organ and its owner remaining quiet, I proceed as follows: In vocal nodules I pick up the affected cord gently, turn it nearly to an angle of 45 degrees, that I may see its under-surface, using for this purpose the baby forceps of Killian. If the nodule is of pin-head type, I pick it off with the Killian baby double cup-forceps. These are so small that they can be applied as accurately as one would pull a single hair from a follicle.

"If the growth occupies the superior surface and is seen to involve mainly the subepithelial structures, I split the surface layer with the knife and pick out the small tumor with appropriate forceps, reapplying the surface membrane and dressing the wound with tincture of benzoin compound, which will cover the area as collodion would on the skin surface. Absolute rest to the voice for forty-eight hours will show the wound healed and practically free from inflammatory reaction. Two cases operated on in this way have had clear tones restored and no recurrence thus far—five months.

"In single pedunculated tumors I proceed by picking up the

tumor with the forceps, encircling its base with a wedge-shaped incision, and remove it by clear dissection with a knife. In one case operated on in this way quite a raw surface was left, which I closed by stitching, using the finest plain catgut. I believe this to be the first instance on record of stitching in the larynx through the mouth, and the results were a perfect healing, with as little reaction as one sees in a skin wound healing by primary union.

"This to me is far more surgical than the older method of removing by tearing, pulling, or twisting forces which must obviously carry with it adjacent normal mucous membrane, leaving a surface to heal by granulation and producing a scar of more or less size, the contraction, perhaps, interfering with the normal function of the part.

"Single papilloma are grasped with the forceps and shaved off below the level from which they spring. One case of this type left but little raw surface, healed kindly, and has not recurred. I have often wondered why multiple papilloma recur with such tenacity. The same tumors appearing on the skin and having the same histologic characteristics are removed by the dermatologist without recurrence unless the procedure is not complete, when they will recur with the same frequency as occurs in the larynx."

The surgery of the trachea and bronchi is confined mainly to the removal of foreign bodies and to the diagnosis of certain obscure conditions causing stenosis of these tubes. The technic consists in the use of suitable instruments through bronchoscopic tubes which are passed through the direct laryngoscope. A description of general methods would mean little, for the operator must individualize in each case. Certain men like Chevalier Jackson, of Pittsburgh; Richard Johnston, of Baltimore, and Sidney Yankauer, of New York, have become most expert in this work, and, as success depends greatly on the experience of the operators, it seems to the writer that, in all fairness to the patient, cases needing bronchoscopic examinations should be put in the hands of those men who have become most adept in the use of such instruments.

The surgery of the nose and throat to-day covers an enormous field in which special acuity is often necessary. The surgical advance has been so rapid that it is difficult even for those who are specializing in it to keep up with the very latest procedures. The laryngologist, as he perfects the technic of his intranasal and intra-

oral work, is constantly breaking down the limitations that were previously forced upon him. External surgery of a specialized sort, such as plastic surgery of the face, has found its proper place; so also the external operations for diseased conditions of the sinuses. It will be recognized, as time goes on, that the laryngologist is the head and neck surgeon *par excellence*, and that he is the man to do intracranial operations, operations on the thyroid gland, and the surgery of the triangles of the neck. Just as the gynecologist is seeking recognition as an abdominal surgeon because he knows that he knows the anatomy of the abdomen better than any one else, so the laryngologist will seek recognition in broader fields of head and neck surgery.

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